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58-D Paul Drive,
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PUBLISHER/EDITOR
Don Neel

ASSOCIATE PUBLISHER
Tina Vierra

SENIOR EDITORS
Carol Caldwell-Ewart
Elinor Pravda

PRODUCTION
COORDINATOR
Demitrius Handelih

ART DIRECTOR
Terry Lockman
Lumina Designworks

CONTRIBUTING
EDITORS
Eleanor Heald
Ray Heald
James Kennedy
Glenn McGourty
Bruce Zoecklein

CONTRIBUTING
WRITERS
Jack Heeger
Millie Howie
Craig Root
Rachel Dumas Rey
Dr. Richard Smart
Robert Tracy

ADVERTISING
REPRESENTATIVES

WEST
Leslie Chase
707/765-2546

EAST
Jim Oot
973/335-8902

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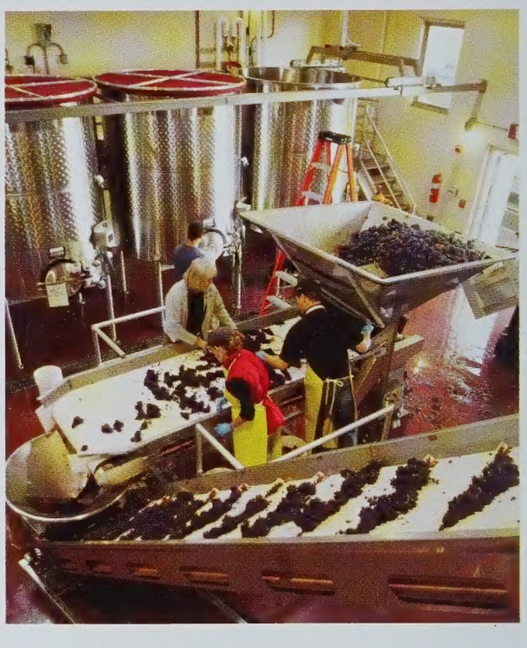

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WINEMAKING

NITROGEN management — Critical for wine flavor and style

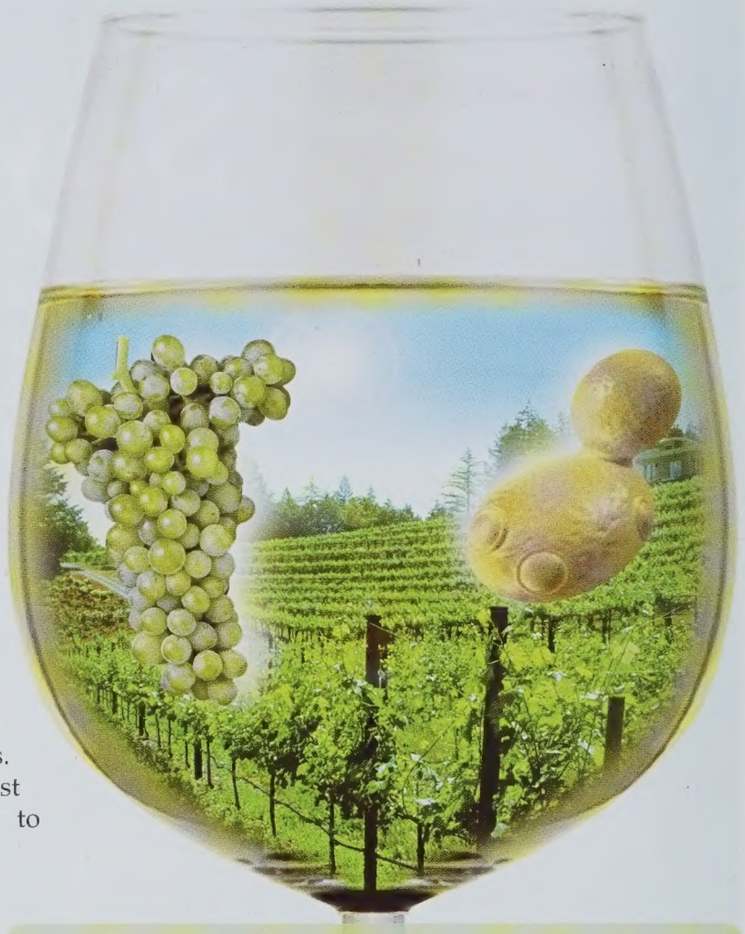

Figure I. Summation of free amino nitrogen and ammonia nitrogen levels provides a useful estimate of the yeast assimilable nitrogen (YAN) level.

BY **Maurizio Ugliano, Paul A. Henschke, Markus J. Herderich, Isak S. Pretorius, The Australian Wine Research Institute, Glen Osmond (Adelaide) SA, Australia**

"Winemaking begins in the vineyard" is a mantra that has widespread support amongst winemakers. It conveys the concept of vineyard or in French jargon, *terroir*, as an intrinsic property of grape, and consequently the corresponding wine. There is no doubt that many great wines are associated with great vineyards. Where do yeast fit in?

The perception that fermentation yeast faithfully transform grape must into wine has been changing in the detail over several decades. This is a result of science uncovering the many roles that yeast perform, and the wider selection of strains available that promote these various attributes.

For example, whereas most strains produce a relatively similar, generic, fermentation bouquet, only some strains possess a strong ability to hydrolyse cysteine conjugates responsible for Sauvignon Blanc character, meaning that only selected strains can enhance varietal expression.[3,4]

Winemakers today have many options through fermentation management to enhance the varietal characteristics of their wine, or to express further regional attributes. Furthermore, yeast strongly respond to their environment.

It is well-known that temperature affects the rate of fermentation, that grape solids enhance survival, and that high osmotic stress, as imposed by a *Botrytis*-affected must, leads, not only to increased glycerol production, but also to higher volatile acidity. The latter example highlights the remarkable ability of yeast to adapt to stressful (such as high sugar) environments. However, there is an accompanying metabolic adaptation, which can have positive or negative flavor implications.

At the time of inoculation, yeast are subjected to a range of stresses to which the cell must adapt in order to exploit its new environment. Some of the known stresses are osmotic pressure, oxidative conditions, sulfite toxicity, and temperature shock.[4]

Nutrients, whether present in sub- or super-optimal concentration can also induce stress and metabolic responses. The primary response is aimed at protecting the cell from committing to reproduction when key nutrients are lacking or dealing with potential toxicity when the concentration is outside the normal range. The metabolic response often involves a cascade of biochemical reactions, some of which can lead to altered metabolism of nutrients such that the yeast will secrete end-products in different amounts.[2]

Some of the end products that have sensory properties can lead to changes in the flavor profile of a wine. H_2S formation is an all-too-well-known example relating to nitrogen depletion-stress.

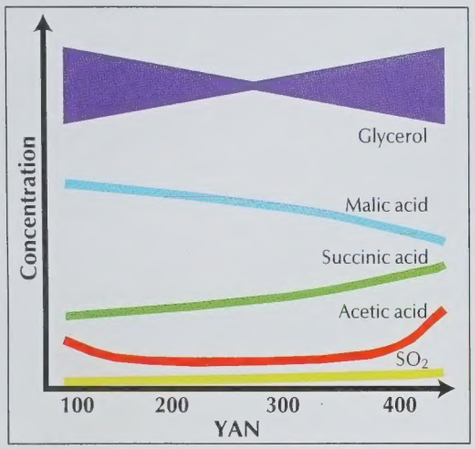

Figure II. Effect of yeast assimilable nitrogen (YAN) on production or utilization of major metabolic products of sugar fermentation.

Clearly, the vineyard environment and intervention by the viticulturist shape the development of the vine and especially the grape composition. Because the viticulturist attempts to balance a long list of priorities in order to produce fruit to specification, most attention will focus on those factors that cannot be modified once the fruit has been harvested. Therefore, yeast nutrients, especially nitrogen, might not be optimized for fermentation, largely in the belief that nutrients can be easily corrected in the winery.

Given that we estimate that up to 500 tons of diammonium phosphate (DAP) could be used each year to produce Australian wine, is this winemaking input being used effectively?

Our current state of knowledge on the implications of controlling vineyard nitrogen as opposed to fermentation nitrogen on fermentation performance and wine composition has been recently reviewed by S.J. Bell and P.A. Henschke.[5]

In this article, we will focus on the role that fermentation nitrogen has in modulating metabolism and some of the changes that this can have on wine flavor. We will first summarize current best practice for managing fermentation nitrogen and then describe the main flavor changes that are affected by nitrogen. Finally, we will consider the flavor implications of nitrogen for white and red wine fermentations.

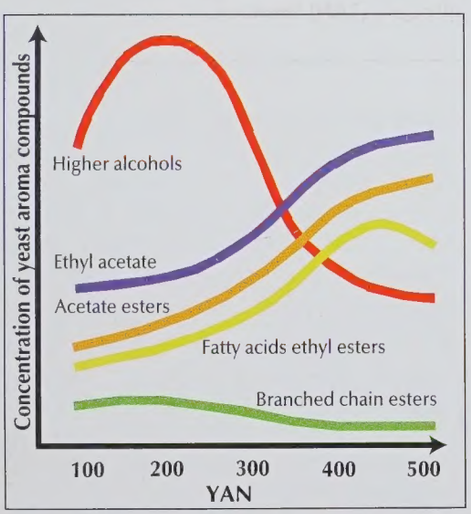

Figure III. Relationship between initial YAN concentration and final concentration of volatile compounds after fermentation.

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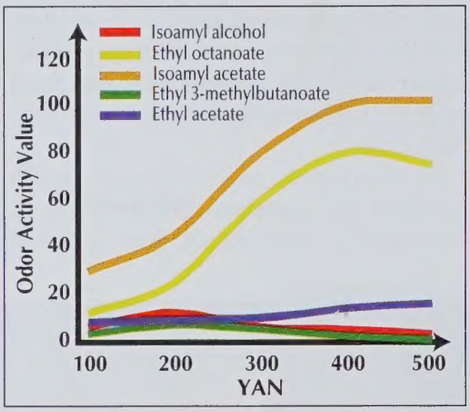

Figure IV. Theoretical relationship between initial YAN concentration and Odor Activity Values of selected yeast-derived aroma compounds.

CURRENT BEST PRACTICE FOR MANAGING FERMENTATION NITROGEN

A common winemaking practice is to make a standard addition of DAP to the juice or must (100 to 300 mg/L) at inoculation without measuring the nitrogen concentration. This article will show that a DAP addition has significant flavor consequences and that measuring the initial nitrogen concentration provides the opportunity to adjust DAP addition not only to achieve an adequate fermentation rate, but also to more reliably guide the flavor profile and style of wine required. This work is still in a conceptual stage based on studies with Chardonnay and Shiraz; however, it should stimulate winemakers to experiment with these and other varieties.

Measuring YAN

Grapes contain a variety of nitrogenous compounds of which the most important are the primary or alpha amino acids, ammonium ion, and small peptides. Proline, a dominant secondary amino acid in many grape varieties, cannot be assimilated under anaerobic conditions.[24] These nitrogenous compounds, excluding proline, constitute what is commonly referred to as yeast assimilable nitrogen (YAN).

Because amino acids are chemically-diverse molecules, the most convenient measure of assimilable nitrogen relates to assaying the free or alpha-amino group of the primary amino acids, which is commonly referred to as free amino nitrogen (FAN). Proline, a secondary amino acid, and protein are excluded in FAN assay methods.

Of the several chemical, enzymatic and physical methods available,[5,15,31] the method of choice is the o-phthaldialdehyde/N-acetyl-L-cysteine (NOPA) method.[13] An additional enzymatic method is needed to determine ammonia, of which 82% is nitrogen. Summation of these two nitrogen measurements yields YAN (Figure I). This procedure is used by NATA-accredited laboratories such as the AWRI Analytical Service Laboratory (http://www.awri.com.au/analytical_service/analyses/yeast_assimilable_nitrogen/), which can provide a timely service during vintage.

The so-called Formol Titration is a simpler, rapid method for measuring YAN,[15,17,31] although the use of formaldehyde, a toxic volatile reagent, requires a well-trained analyst and suitable laboratory. Mid-infrared (MIR) spectrometry, which is very rapid, has recently been developed by the AWRI.[10]

YAN measurements, ideally, should be performed directly on juice or must samples at the point of inoculation to avoid over-estimation due to processing losses which inevitably occur between vineyard and the fermentor. Furthermore, juice samples taken from grape musts can under-estimate total berry YAN due to an important proportion of amino acid contained in the grape skin. S. J. Bell and P. A. Henschke published a detailed discussion of these points.[5] Nevertheless, an early warning for low YAN can be achieved by sampling in the vineyard one to two weeks before harvest, such as during maturity sampling.

Supplementing must YAN

The YAN content of Australian grape juices varies widely from approximately 50 to 350 mg/L, with a mean value of around 200 mg/L. As a benchmark, it is generally agreed that maximum yeast biomass yield and fermentation rate results when YAN exceeds 400 mg/L, whereas 150 mg/L YAN marks a transition zone, below which the risk of slow or stuck fermentation becomes notably increased.[6,21]

Since much of the background research work to establish these

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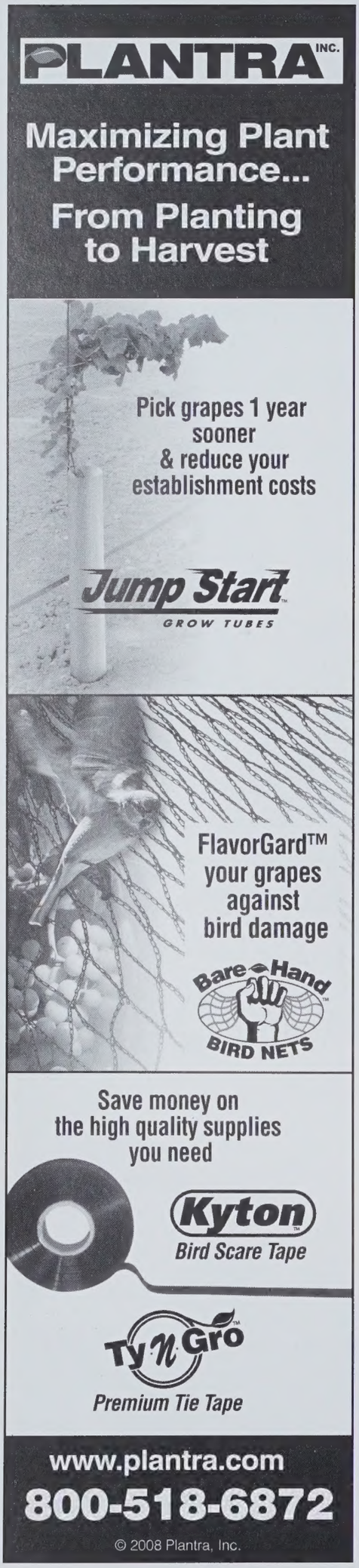
benchmarks has been carried out in synthetic and filtered grape juices, this risk value is technically only valid for highly clarified, anaerobic, juice fermentations. Nonetheless, it represents a useful guide for other types of fermentation.

In general, in order to achieve an adequate rate of fermentation to dryness, a cellar bright juice containing less than 150 mg/L YAN should be supplemented with nitrogen to at least 150 to 200 mg/L when the source vineyard has a history of low YAN fermentation problems or a high nitrogen demanding yeast has been selected. Nitrogen supplementation should be increased to the higher end of the range for higher °Brix juices, whereas juices containing grape solids, or fermentations that are aerated, are less susceptible to low YAN difficulties.[6,14,29]

Later in this article, when we consider the flavor consequences of juice YAN content, some winemakers might choose to supplement low YAN juices up to a final concentration of 250 to 300 mg/L YAN to produce a cleaner, fruitier style.

DAP is widely used as a YAN supplement for this purpose. DAP contains 21% N, therefore, for convenience we can consider 100 mg DAP to contain 20 mg YAN. For example, it will be necessary to add 500 mg/L DAP to a juice to increase its YAN concentration from 100 mg/L to 200 mg/L. While this amount seems a large DAP addition, the YAN equivalent of 1.5 g DAP would be needed to reach the point at which a maximum fermentation rate would be achieved. Australian winemakers can visit the AWRI website to access the calculator to estimate DAP additions: http://www.awri.com.au/practical_solutions/calculators/.

One disadvantage of DAP as a supplement is the acidification, that



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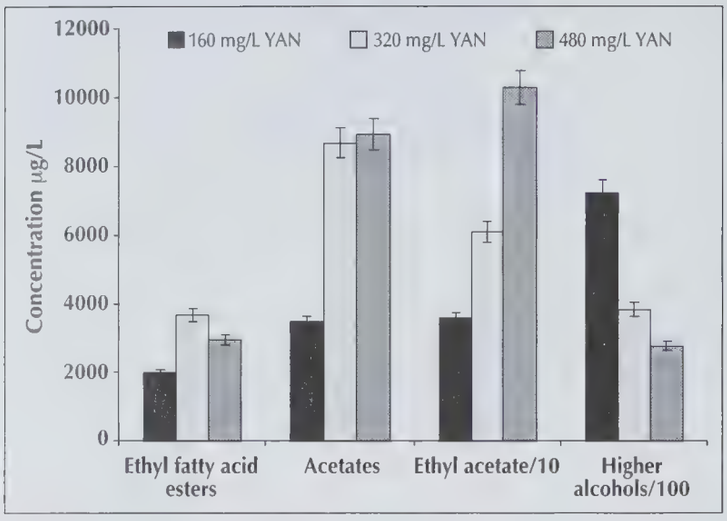

Figure V. Volatile compounds of wines obtained from a low YAN (160 mg/L) Chardonnay juice supplemented with two increasing concentrations of DAP, to a final YAN of 320 mg/L and 480 mg/L, respectively. Fermentations were carried out at 18°C using *S. cerevisiae* AWRI 796.

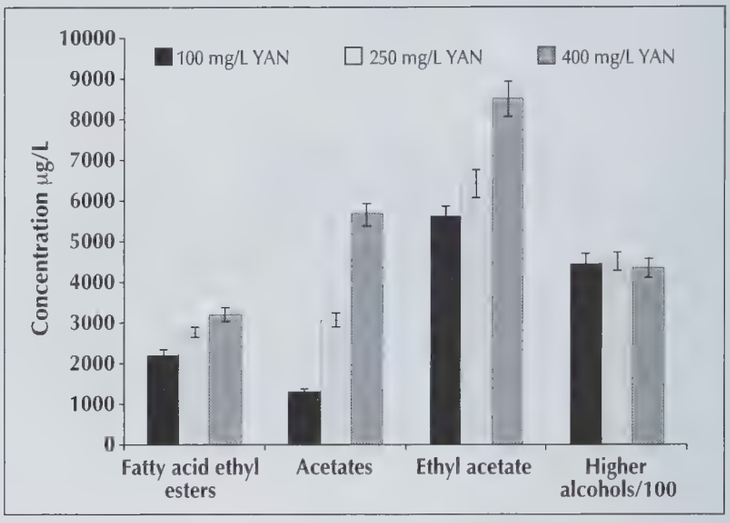

Figure VII. Volatile compounds of wines obtained from low YAN (100 mg/L YAN) Shiraz grapes supplemented with two increasing concentrations of DAP, to a final YAN of 250 mg/L and 400 mg/L respectively. Fermentations were carried out at 22°C using *S. cerevisiae* AWRI 796, with cap plunging three times per day.

can result in some juices, leading to a lower than expected wine pH. Utilization of the ammonium cation by yeast results in a release of a H^+, which is secreted by the cell, thereby lowering wine pH. Furthermore,

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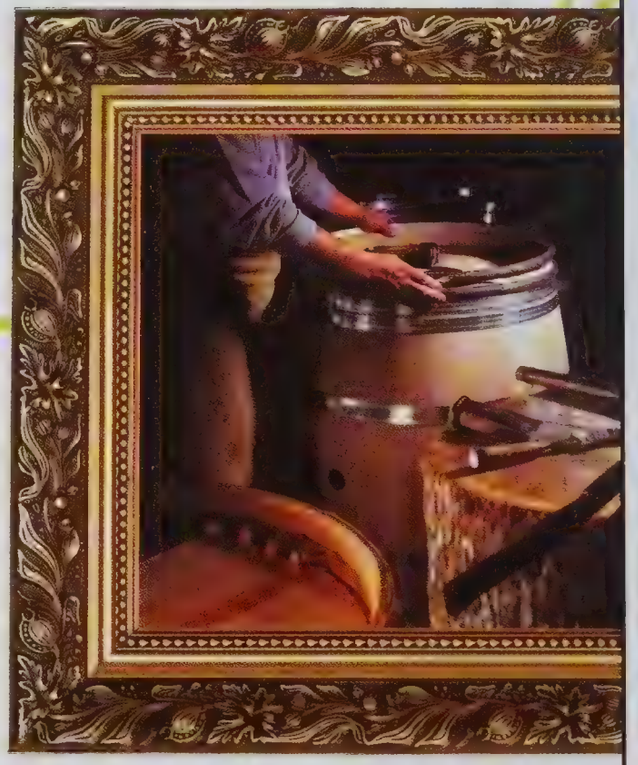

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large additions of DAP can lead to excessive wine phosphate content.

In practice, the maximum addition of DAP is limited by the concomitant concentration of soluble phosphate remaining in the wine, which is set at 400 mg P/L (Australian and New Zealand Food Standard 4.5.1). This concentration of phosphate-P would correspond to a maximum of 1.7 g/L DAP (equivalent to 360 mg/L YAN) if we assume that the juice/must contained no phosphate; in practice a lesser amount of DAP can only, therefore, be added.

Overuse of DAP can also stimulate overproduction of acetate esters, especially ethyl acetate, resulting in the perception of volatile acidity (VA). As discussed in the following sections, high YAN (exceeding 450 to 500 mg/L YAN) can stimulate ethyl acetate production by many yeast strains.

When working with very low YAN juices, we have observed that other nutrients can similarly be low. Thus, when YAN is low and other nutrient deficiencies are suspected, it can be useful to add a proprietary yeast food that contains more complex forms of N, and vitamins, lipids, and minerals. Indeed, continued H_2S production after DAP addition suggests a general vitamin deficiency,[20,39] though other causes are also possible. Most yeast suppliers can advise on the use of yeast foods, which are generally produced from inactivated yeast.

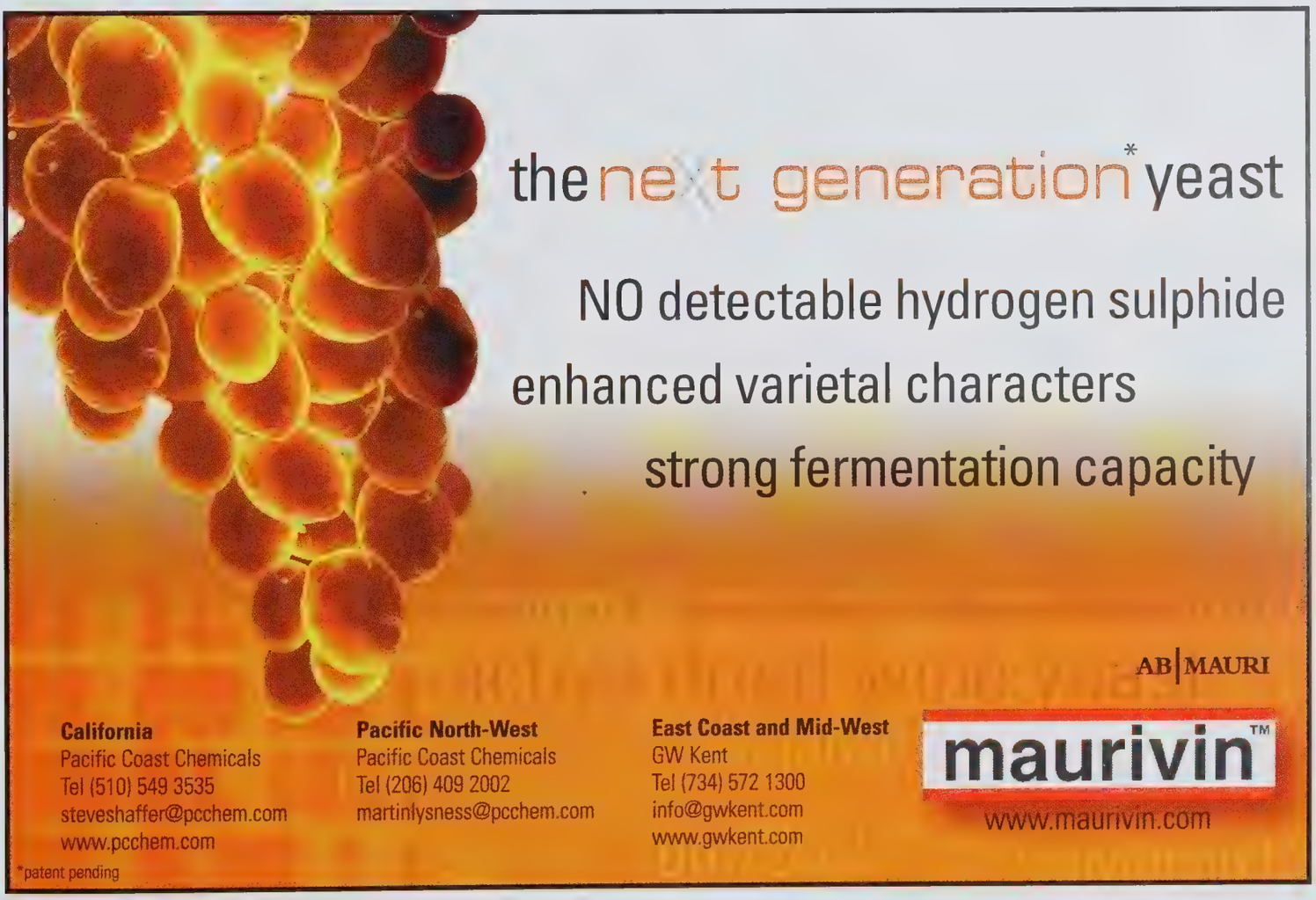
General metabolic responses of yeast to YAN

The principal role of sugar metabolism in yeast is to generate energy and carbon skeletons for building all the components of the cell. These metabolic activities result in the accumulation of several by-products, including esters, higher alcohols (also known as *fusel alcohols)* and polyols, carbonyls, acids and thiols which contribute to the aroma and flavor of wine.

Nitrogen metabolism, which is involved in the assimilation of nitrogen for the synthesis of protein and nucleic acids, also contributes to the pool of aroma and flavor compounds. Because nitrogen metabolism is central to cell growth, it regulates other pathways, including sugar and sulfur metabolism. Consequently, nitrogen availability can significantly impact on the production of many flavor-active metabolites. The nitrogen status of a juice or must, therefore, contributes to wine flavor and affects yeast growth and the fermentation of sugars.

Major fermentation products

In addition to ethanol and CO_2, other major products of sugar metab-



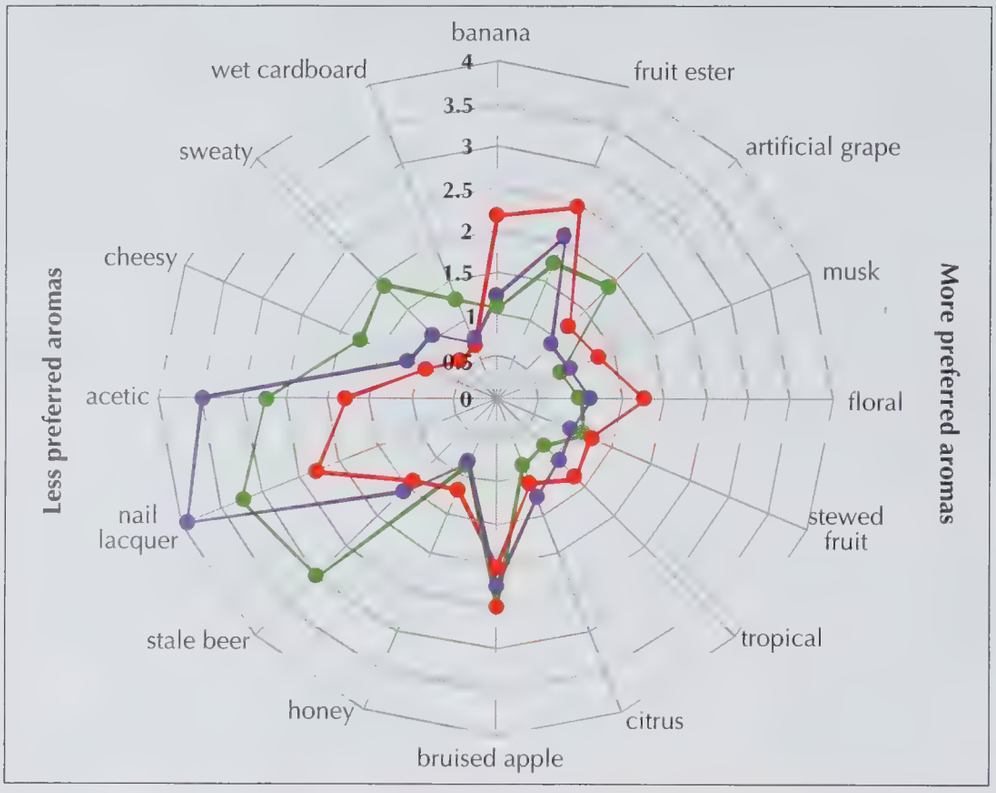


Figure VI. Sensory characteristics of wines obtained from a low YAN (160 mg/L) [green line] Chardonnay juice supplemented with two increasing concentrations of DAP, to a final YAN of 320 mg/L [red line] and 480 mg/L [blue line], respectively. Fermentations were carried out at 18°C using *S. cerevisiae* AWRI 796.

olism are the polyols, such as glycerol and butanediol and the organic acids, especially acetic and succinic acids and, to a lesser extent, the ketoacids, such as pyruvic acid and α-ketoglutaric acid. The production of many of these primary metabolites of sugar metabolism is modulated by YAN, although the magnitude of changes has been observed to depend on the yeast strain under consideration.

Furthermore, the type of nitrogen source used, DAP or amino acids, affects metabolite production.[1] Because low YAN juices are typically supplemented with DAP, only the impact of ammonium ion concentration on the production of yeast metabolites will be discussed in this article.

Ethanol is the major product of sugar fermentation, however, while DAP addition increases yeast growth and the rate of fermentation, it has little to no practical effect on final ethanol yield. Theoretically, DAP-grown yeast are forced to synthesize amino acids for cell growth when compared with amino acid-grown yeast. This decreases the proportion of sugar available for ethanol production,[1] but, in our experiments, this has a minor affect on ethanol yield.

Glycerol and acetic acid, which are important to wine composition and flavor, respond relatively strongly to juice YAN concentration.[1,36,38] Figure II summarizes general trends observed in synthetic juice and white wine fermentations. Both glycerol and acetic acid production depend on the yeast strain used.

For example, when using yeast Vitilevure M05, YAN addition increases glycerol production, whereas the

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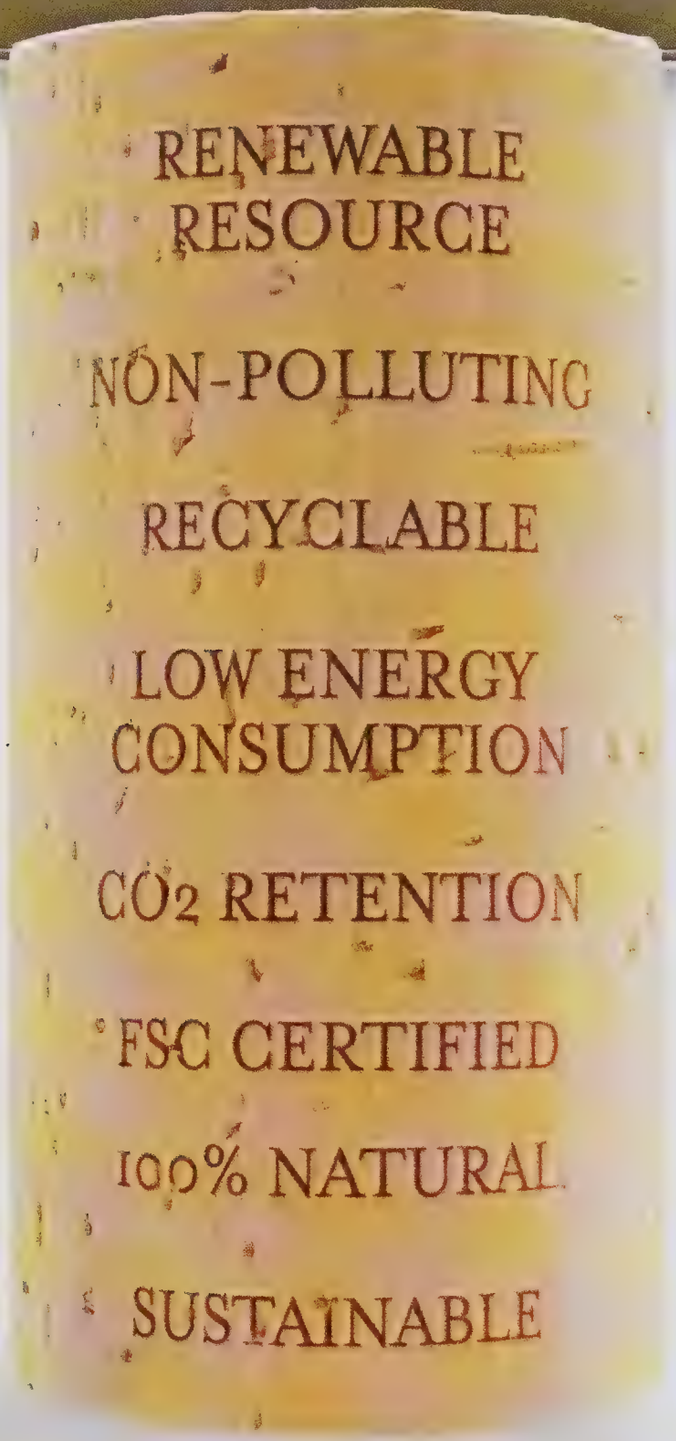

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reverse is the case for AWRI 796.[38] Both yeast, however, produce the lowest concentrations of acetic acid at moderate YAN concentrations (range of 200 to 250 mg/L) while higher concentrations are produced at both lower **and** higher concentrations of YAN. Malic acid consumption does, however, increase with increasing YAN concentration, irrespective of yeast strain. On the contrary and depending on the strain, succinic acid concentration can increase with increasing DAP addition.[9] In general, YAN can affect the titratable acidity and the balance of organic acids which can affect flavor.[33]

Sulfur dioxide production during fermentation can also be stimulated by initial YAN concentration, but the response seems to be yeast strain-dependent. Experimental work in synthetic media and wort suggests that low SO_2 is produced in low YAN media but increases when initial YAN availability is higher.[12,27]

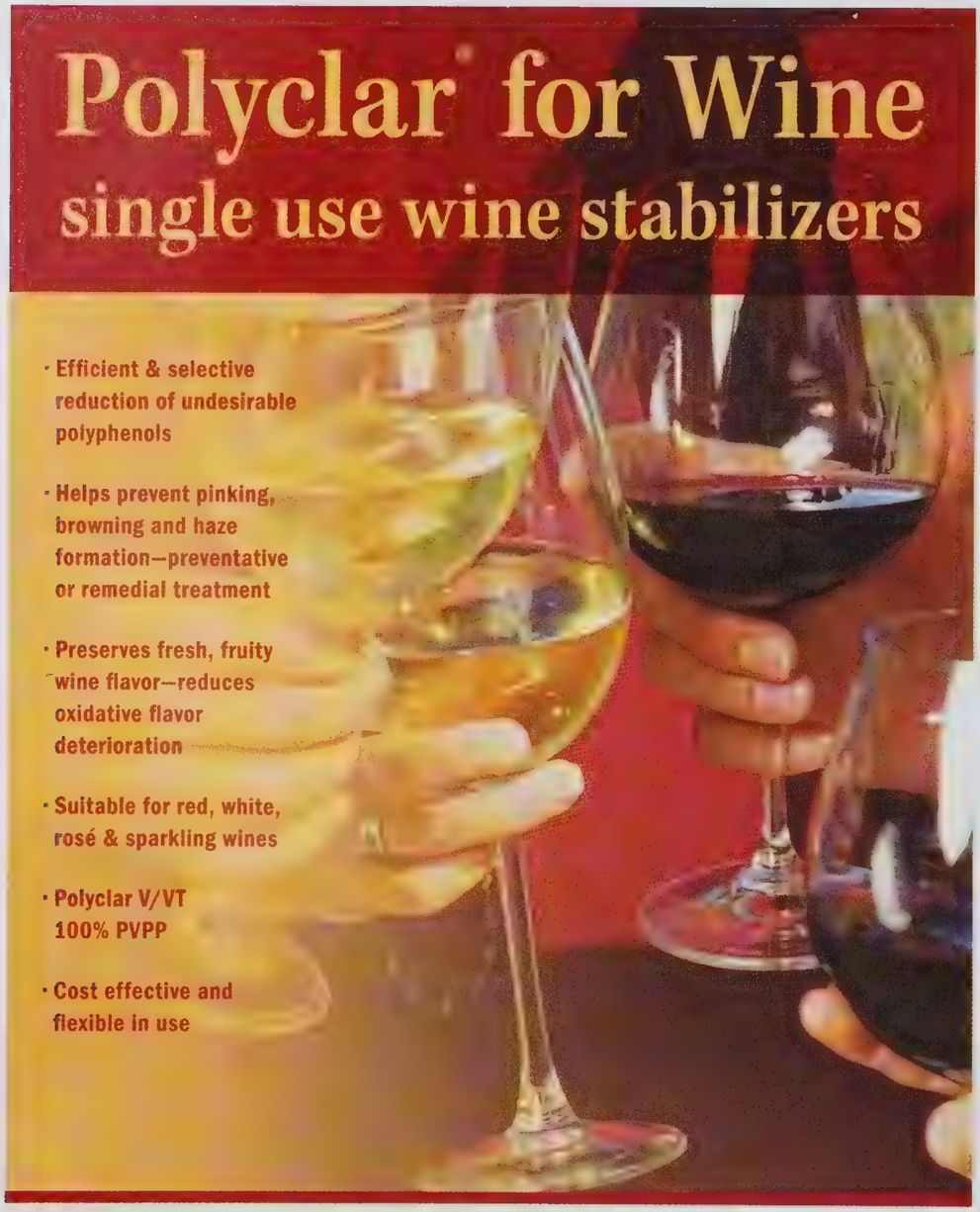
SO_2 production contrasts with H_2S production, which is generally lowered by increasing YAN. Increased risk of malolactic fermentation inhibition has also been associated with high YAN addition but this inhibition has not been conclusively correlated with SO_2 production.[27] Nevertheless, until better information is available, consideration should be given to limiting high YAN conditions when malolactic fermentation is required.

Volatile aroma compounds

Among the various yeast metabolic pathways that are influenced by the nitrogen composition of the juice, those leading to volatile compounds are of particular importance, due to the primary role played by fermentation-derived volatiles in the aroma character of wine.[32] Several studies have indicated that both the total available nitrogen and the balance of amino acids and ammonia can significantly affect production of different groups of fermentation-derived volatile compounds.

From a practical viewpoint, the problem of juice nitrogen composition is primarily linked to the frequent occurrence of juices with sub-optimal concentrations of nitrogen, and higher risk of slow or stuck fermentation. As this problem is frequently corrected in the winery through the addition of DAP, several studies have investigated the implications of this common winery practice on the volatile composition of wine.[3,8,22,23,28,35,38]

Due to the variety of yeast strains and fermentation conditions employed, it is somewhat difficult to extrapolate from the literature definitive conclusions concerning the effect of DAP addition on wine aroma. Nevertheless, some general trends relating DAP supplementation and wine volatile composition are summarized in Figure III.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Higher alcohols, which are directly related to amino acid metabolism in the cell, exhibit a characteristic behaviour. Therefore, when total nitrogen is increased by adding ammonium to a medium containing very low levels of YAN, the production of high alcohol is initially increased, but then tends to decrease after a peak between 200 and 300 mg/L YAN. This activity depends on various factors, including yeast strain and fermentation conditions.

AUTHOR NOTE: The term "higher alcohols" refers to those alcohols that possess more than two carbon atoms and that have a greater molecular weight and boiling point than ethanol. Higher alcohols, also known as *fusel alcohols*, are quantitatively the largest group of aroma compounds in many alcoholic beverages. They are recognized by a strong, pungent smell, and taste and have a significant effect on the sensorial quality and character of the wine and brandy.

Higher alcohols are characterized by herbaceous, fusel-like odors, and are generally thought to contribute to wine fermentation bouquet complexity. However, when present in very high concentrations, they can have a negative impact on wine aroma, mainly because they mask fruity characters.

Several authors have reported that ammonium supplementation can improve wine sensory quality by lowering the production of higher alcohols.[28] However, based on the trend shown in Figure III, this advice has to be taken cautiously, as it might apply only to fermentations with initial YAN in the range included in the descending part of higher alcohol production pattern, such as YAN less than 200 mg N/L.

The production of fatty acids, ethyl esters, and acetate esters, including ethyl acetate, is generally increased when DAP is added to a low YAN juice prior to alcoholic fermentation (Figure III). This can have interesting implications for wine flavor, as fatty acids, ethyl esters, and acetates are generally responsible for the fruity character of wine.[19]

However, ethyl acetate, one of the dominant yeast-derived volatile metabolites, when present in very high concentrations, can give unwanted sensory characteristics, often described with terms like nail lacquer/solvent and volatile acidity. Branched-chain esters are, from a quantitative viewpoint, the less abundant volatiles produced during fermentation. Although their contribution to wine flavor has still to be clarified, tentative evidence is available in the literature for these compounds to be important contributors to the red berry fruit character of some red wines.[11] Their concentration appears to decrease with increased DAP additions, however.

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The existence of a variety of different responses for the various groups of yeast-derived volatile compounds to DAP supplementation arises from the fact that each group of volatiles is derived from a different metabolic pathway, each of which respond differently to DAP supplementation. However, from a practical viewpoint, understanding the potential of DAP supplementation as a tool to modulate wine sensory characteristics cannot be based simply on compositional data.

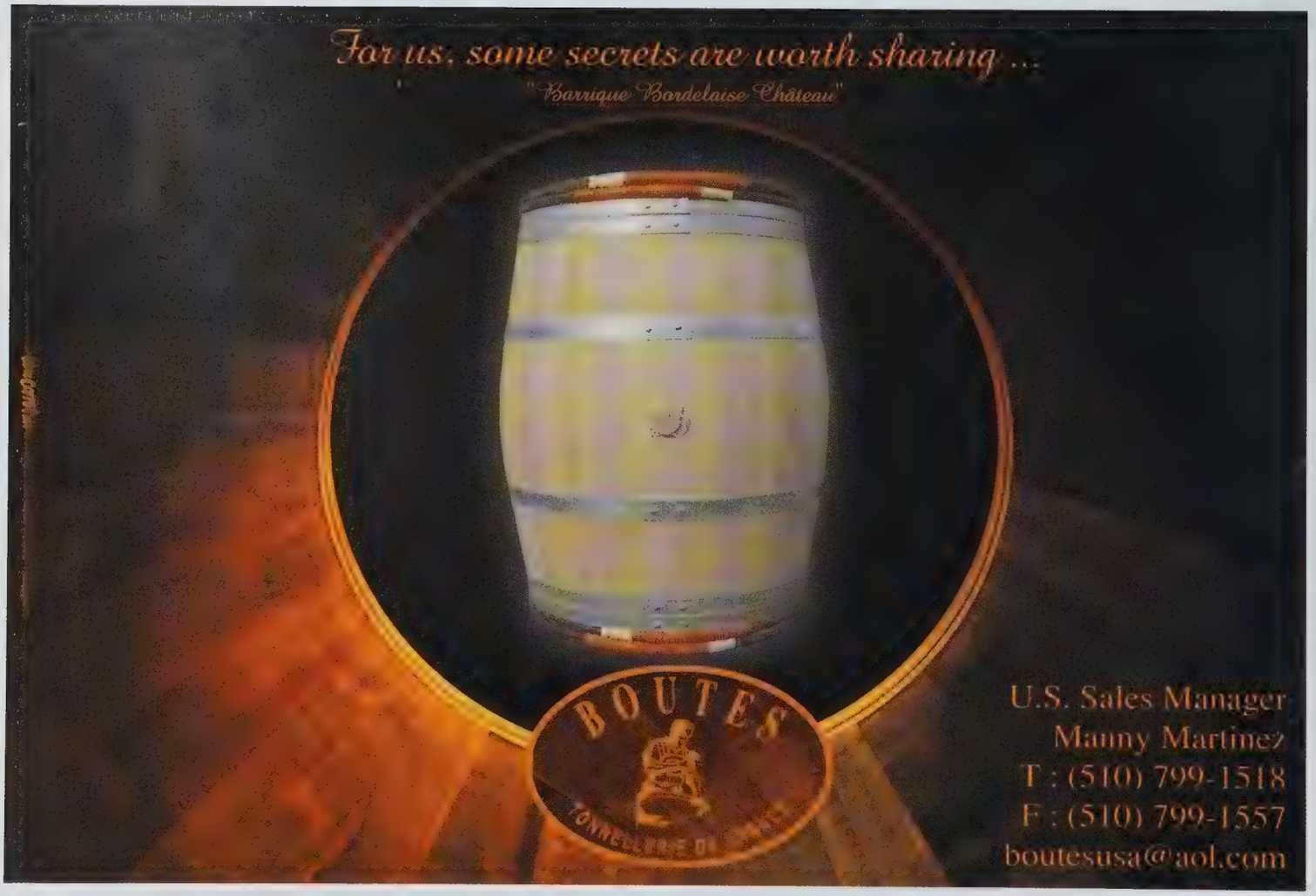
The various volatiles or groups of volatiles illustrated in Figure III occur in wine over an extremely broad range of concentrations, however, Figure III does not represent the actual quantitative relationship between different chemical species. For example, higher alcohols, characterized by herbaceous, fusel-like odors, typically occur in concentrations that can be up to 400-times higher than ethyl fatty acid esters, characterized by fruit-like odors.

Nevertheless, relatively small variations in the concentration of ethyl fatty acid esters, such as those introduced by variations in YAN content, are more likely to affect the aroma of wine than if proportionally similar variations would occur for higher alcohols. This is due to the fact that some of the possible sensory modifications associated with changes in the concentration of specific aroma compounds depend, among other factors, on the ability of that aroma compound to generate an olfactory stimulus at a given concentration.

This complex relationship is often simplified by means of the concept of odor threshold, defined as the minimum concentration at which a given compound can be detected by the sense of smell;[18] this is referred to as the odor activity value (OAV). Some of the fermentation-derived volatile compounds, such as esters, that are generally associated with the fruity character of wine, are extremely powerful odorants (have a very low odor threshold), and can, therefore, impart specific sensory attributes even when present in low concentrations.

On the contrary, compounds like higher alcohols possess a much higher odor threshold, and therefore are likely to generate variations in the aroma profile of a wine only if their concentration varies to a very large extent.

In Figure IV, a theoretical relationship between the OAV of selected volatile compounds, belonging to the chemical classes of Figure III, and DAP supplementation is illustrated. It appears clear then that the range of variations potentially introduced by DAP in the concentration of acetates and fatty acid ethyl esters (isoamyl acetate and ethyl octanoate are used as reference compounds for these two classes), can have a dramatic impact on the volatile character of wine, whereas variations in compounds



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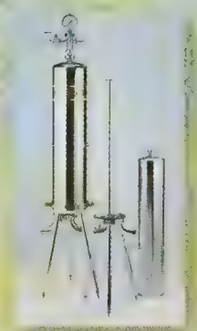

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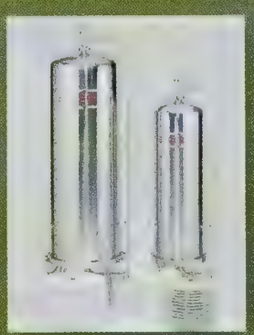

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such as higher alcohols (isoamyl alcohol), although quantitatively extremely large, are likely to have a limited impact.

Although it has to be stressed that OAVs only give a projection of the potential of a given compound to contribute to the overall aroma of a wine, the trends shown in Figure IV provide a good indication of which of the compositional changes associated with DAP supplementation is likely to have a greater impact on wine aroma.

IMPLICATIONS OF NITROGEN FOR WINE FERMENTATIONS

Implications of nitrogen for white wine fermentations

The results obtained in various winemaking trials conducted at the AWRI with sub-optimal YAN juices have indicated that, under typical winemaking conditions, DAP supplementation is an extremely powerful tool for modulating the production of esters, which, based on the previous discussion, are probably the most sensorially interesting group of compounds generated during fermentation.

Figures V and VI show the variations in volatile compounds and the sensory profile of Chardonnay wines made at different DAP concentrations. In good agreement with the theoretical trends shown in Figure IV, DAP had a positive effect on ester production, while it lowered the formation of higher alcohols.

However, the wines obtained with moderate nitrogen supplementation of the juice were preferred by panellists compared to those obtained without or with high DAP addition. This preference might be due to a combination of higher acetates, ethyl fatty acid ester concentrations, and moderate levels of ethyl acetate, the latter being associated with unwanted solvent-like characteristics when present at very high concentrations.

DAP addition to low YAN juices also suppresses the production of H_2S and mercaptans by many wine yeasts, which although not quantified in this study, no doubt contributed to the preference of the moderate YAN wines. The impact of DAP addition on the production of fruity thiols, such as 4MMP, 3MH and 3MHA, still needs to be determined.

These results highlight the complexity of predicting wine aroma from compositional data. They also underline the importance of measuring YAN and adding the appropriate amount of DAP, if necessary, before or during fermentation, in order to reduce the potentially negative effects that inadequate or excessive DAP supplementation can have on wine aroma. Particularly, the risk of excessive formation of ethyl acetate has to be considered, as this ester is relatively stable during wine ageing, compared to other acetate and ethyl fatty acid esters, which tend to decrease significantly after several months of bottle storage.

Implications of nitrogen for red wine fermentations

More recently, researchers at the AWRI have investigated the effect of DAP supplementation on the volatile composition of Shiraz wine.[37] It is generally believed that the conditions normally adopted for the production of red wine (such as high temperatures, aeration of the fermenting must during cap management operations, extraction of YAN and other nutrients from skin during maceration) render fermentations less susceptible to slow or stuck fermentations, even when YAN concentrations are low.

Nevertheless, several surveys have shown that YAN levels in red grapes can be well below the range considered optimal for model and white fermentations (M. Ugliano and P. A. Henschke, unpublished data).[7,16,26]

Although during red wine fermentations YAN-deficiencies are likely to

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have a more moderate effect on fermentation kinetics, they can still negatively affect the formation of important aroma compounds. From the results of a trial, which carried out fermentation of a low YAN Shiraz must (YAN 100 mg/L) with *S. cerevisiae* AWRI 796, it is again clearly evident that DAP supplementation is a powerful tool for modulating the volatile composition of red wine. This confirms some of the trends observed during experiments with model substrates and white grape juices.

In Figure VII, DAP supplementation resulted in higher production of ethyl fatty acid esters and acetate esters, while higher alcohols were scarcely affected.

Preliminary results also indicated that YAN supplementation of must can have an impact on red wine color composition. Analytical parameters related to color intensity and hue were indeed found to vary with DAP supplementation.[37] The factors responsible for this effect are currently being investigated at the AWRI. The effect might be ascribable to various aspects of yeast metabolism that are known to modulate wine color and phenolics composition. Factors include variations in the rate of ethanol production, absorption of anthocyanins on yeast cell walls,[25] or reactions with yeast-derived metabolites such as pyruvic acid and acetaldehyde to form pigmented polymers.[30]

Conclusions

This work shows that the concentration of yeast-assimilable nitrogen is not only important for ensuring that adequate yeast growth and fermentation kinetics are achieved, but also can affect the production of the major metabolites arising from sugar fermentation. Whereas ethanol concentration is little affected, that of glycerol and various carboxylic acids can be markedly modulated. These changes are likely to affect wine flavor.

Most important, however, is the finding that YAN can strongly influence production of some volatile metabolites, especially the acetate and ethyl esters, which are known to be positive to wine aroma, when in balance.

The impact of higher alcohols, which can be negative when present in high concentration, can also be modulated by YAN. These various yeast metabolites were also found to vary in red wine fermentations, suggesting that, as in white wines, must YAN can affect the development of wine flavor. Our preliminary data suggest that wine color and phenolics composition can also be influenced by YAN.

Overall, these results suggest that, at least for Chardonnay, the flavor and style of wine is dramatically modulated by the initial YAN concentration of the grape juice. Low YAN level juices favor the production of more complex wines with less fruity aromas, whereas moderate YAN levels produces cleaner and fruitier wines. However, high YAN levels can lead to excessively estery wines.

Similar effects can be expected in other varieties, except for those varieties that depend on thiols, for which no information is currently available. Clearly, more wine sensory studies need to be undertaken to better understand the effects of DAP additions, and must YAN and amino acid profile on wine flavor.

A red wine trial is currently in progress to better understand the impacts of managing nitrogen in the vineyard compared to that in the winery on wine flavor and quality. This research can be expected to provide grape growers and winemakers with better information for optimizing wine style and quality according to consumer

preferences and other desired outcomes. ■

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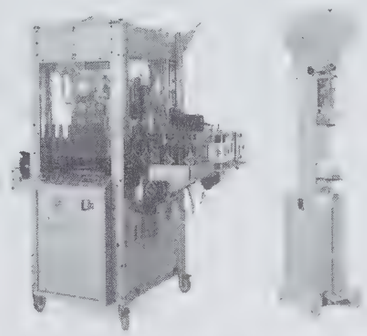
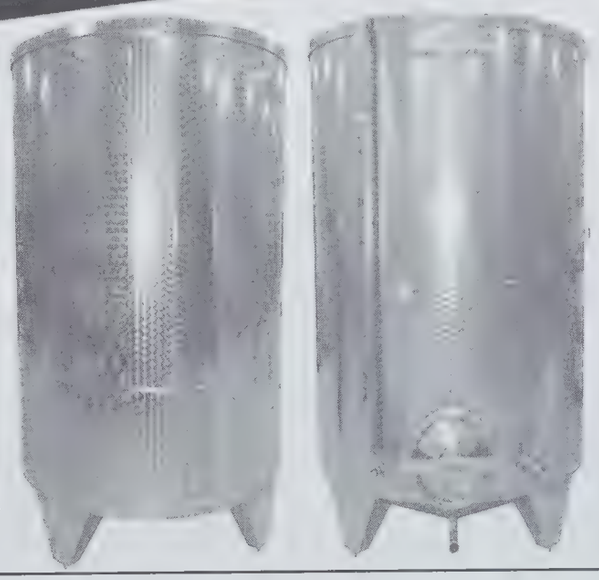
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OBSTACLES AND STRATEGIES FOR SUCCESS

Ownership transitions in the wine industry

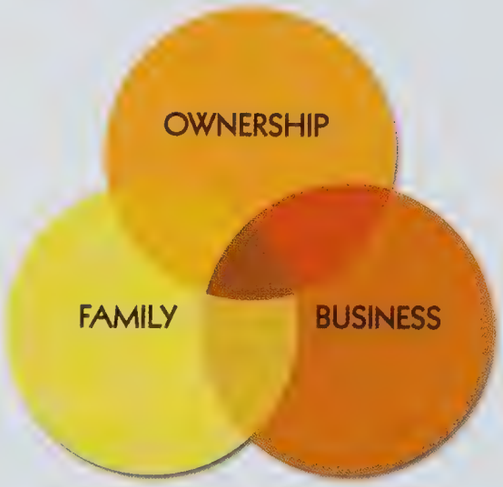
BY Rob McMillan, founder-Wine Division, SVB Silicon Valley Bank
Deborah Steinthal, founding partner, Scion Advisors

Family-owned wineries face unprecedented change in management and ownership in the next five to 10 years. New research findings from a joint SVB Silicon Valley Bank/Scion Advisors report reveals that 51% of western U.S. wineries will transition to new ownership by 2017.

The data collected for this report also reveal that these family-controlled wineries preparing to transition are ill-prepared strategically and financially to successfully change hands to the next generation, transition to professional management, or be sold to a third party. Current ownership is assuming significant financial risk that will translate to the inability to pass ownership to the next generation and/or see reduced returns in a third-party sale.

As the senior generation in the wine business prepares to retire, keeping the winery in the family and preparing for succession present complex challenges for many reasons. In particular, the wine industry has little experience with succession plans, and there are only a few case studies that can offer strategies and best practices to help guide a successful change of control.

SVB Silicon Valley Bank and Scion Advisors teamed up in October 2007 to conduct a comprehensive survey of family wineries throughout California, Oregon, and Washington. An online survey was sent to 2,921 family winery owners, CEOs, presidents, and general managers; 247 family-owned respondents completed the survey.



The majority of survey respondents who desire to keep their wineries family-controlled are unprepared for a successful transition of ownership. Our data also suggest that most owners do not yet understand the risks and the requirements associated with changing ownership, nor are they fully aware of the lead-time needed or steps necessary to effect a successful transition at the best after-tax price. Fewer than half of the owners have begun some form of estate planning. This planning deficiency sets the stage for stressful transitions that may divert precious resources needed to run their wineries effectively.

The overwhelming majority of significant shareholders in family wineries have only limited knowledge of the senior generation's share-transfer intentions. Only a handful has a board of directors to use as a forum in which to discuss family and winery issues. With their family winery at risk, owners who have the ability to engage the whole family in open communication will be more successful in developing beneficial estate plans and successful succession strategies.

What does this mean for the wine industry as a whole? The effects of this massive transition will not be isolated to the individual winery level. The large number of retirements will produce a power shift throughout the industry that could have ripple effects. Regional winegrowing boards, distributor relationships, and industry associations across the market will all be susceptible to the turnover. This is an enormous change for such a small, young industry to absorb.

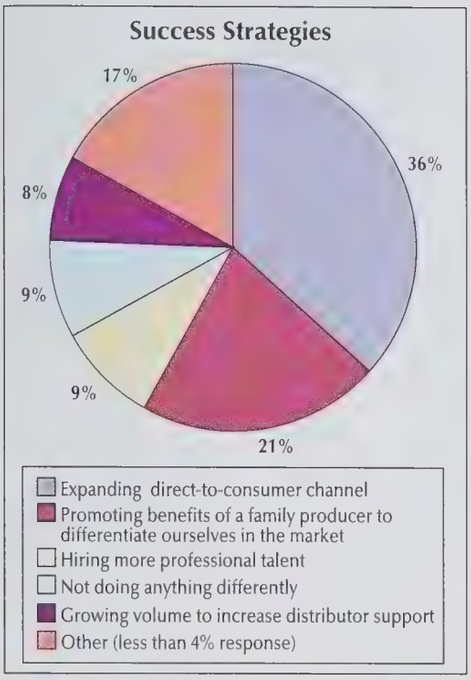
Perhaps the most astounding conclusion of our survey is that the majority of family-run wineries expect to go through a change in control within the next 10 years,[1] and almost a quarter of the industry expects to transition within five years. Taken literally, the results imply the potential of 1,020 wineries industry-wide changing hands.[2] Disturbingly, however, our survey concludes that winery owners are unprepared and have not devised strategies to preserve the wealth they have generated during their lifetimes and transition it to their heirs.

What is causing this massive transition for wineries?

This transformation is gaining its impetus from three separate drivers; 1) normal progression through an industry life-cycle (most of the wineries were founded in the 1970–1980s), 2) the legacy focused desires of founders to see their dreams transition to a following generation, and 3) business issues compounded by a changing industry.

1) Normal progression of the industry life-cycle — Perhaps the magnitude of the impending ownership turnover should not be a surprise, since 88% of the wineries presently operating in California alone were formed after 1975. Many of those entered the business as growers-turned-winery-owners when they could not sell their grapes in a given year. Others were affluent professionals looking for a second, more relaxed career or a "working retirement."

The wine business was young and cottage-based at the time; the pace was

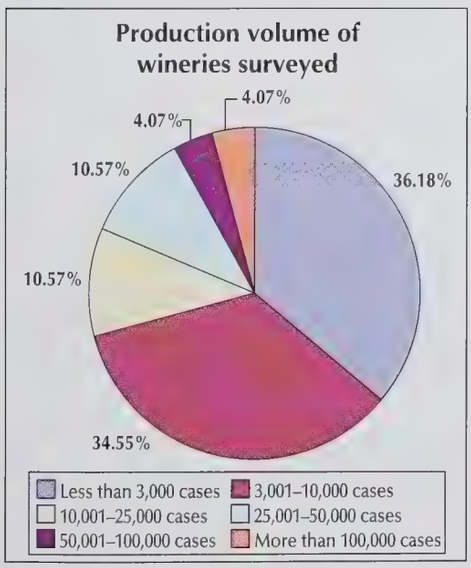


slower, sales were often made out of the back of a truck or out of a cellar door, and most grape contracts were done on a handshake. The Internet was not yet a part of sales, and regulatory compliance was less onerous. We know from survey data and interviews that many owners have found the present business environment not to their liking, beyond their skill sets or energy levels.

2) Family wineries — the next generation — Owners' life-stage is the second issue driving the transformation and the anticipated changes in control. Nearly half of the survey respondents believe the next generation will be ready to take over, and they note a strong desire to see their heirs assume control. They believe they will be ready to watch their inheritors carry the family label into the future.

It should be noted that, while founders are looking for heirs to step up, we have not surveyed the heirs to ask whether living the founder's dream is a dream to which they aspire. In the end, this factor may tilt the final count of transitioning wineries more toward sale to a third party.

3) Business issues supporting change — The wine industry is not just about good wine quality anymore.



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Additional drivers of change are business issues that can be broken into several subcategories.

First, the dominant competitive issue when many of these family-owned wineries started was simply the ability to make great wine. Making great wine has now become the minimum buy-in simply to play.

In a much more competitive industry, the dominant competitive issues have become defining a well-differentiated brand strategy and executing an appropriate sales and marketing plan. Not all winery owners have those skills or have a winery of sufficient size to be able to afford a qualified professional or team capable of differentiating their brand or executing a sales plan.

Second, rapidly escalating trends we observe are wineries that are too small to get distributor attention or too big to sell all-direct. In each case, profits are impaired if the model is out of balance with the price/quality/volume (product and channel strategy) fundamentals.

In a separate 2007 SVB Wine Industry Conditions Survey, the third most cited issue hindering long-term profitability was "being spread too thin." For the small winery feeling increased pressure, the natural tendency is to focus on the present battle and ignore long-term transition planning.

Supporting this observation, less than 10% of family winery survey respondents' top business concerns address long-term transition planning issues; 25% of respondents note national distribution as the largest obstacle to sustained profitability; 16% have problems in direct-to-consumer sales, while 13% note the strength of key staff as their predominant issue.

Financial landscape has changed

Availability of capital is an important issue instigating change. About one-third of the respondents suggest financial reasons for ownership transition. They are owners who need to retire due to estate and tax planning (15%) and owners who simply need liquidity (13%).

It was not that long ago when banks considered lending to the wine industry a risky proposition. That was the landscape in 1994 when Silicon Valley Bank entered the business. Since then, the business has improved and financing vehicles that can assist in a winery's change in control are more available.

It's not too surprising that the survey suggests owners are well aware of the improved market for sale of their wineries. Twenty-three percent cite the public disclosures of the large cash prices being paid for wineries as a factor that they are considering as they weigh both the timing and the method of their retirement.

Lack of effective planning is a major problem

Regardless of the reasons wineries are contemplating change, a major find-

Tax impact of not planning

Upon the death of a winery owner, the government wants its share of your life's work. Without good estate planning, or cash set aside to make this payment, winery assets will need to be sold to meet the estate tax payment, and it will need to be done in the time the government mandates.

What kind of money are we talking about? The net cash impact from tax consequences of a *typical* change in control can run into the millions of dollars. For example, a Northern California winery owner with a net worth of $10 million and 80 acres of land, transferring ownership control to the next generation, can have a net tax impact of $2 to $3 million. With the financial leverage under which most wineries operate, it is unlikely that this can be raised strictly from savings, cash flow, or the sale of non-crucial winery assets. The more likely outcome of this circumstance is the quick "estate sale." ■

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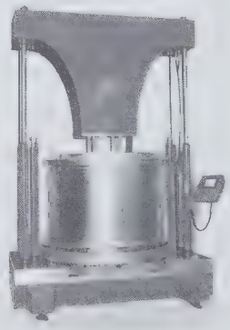

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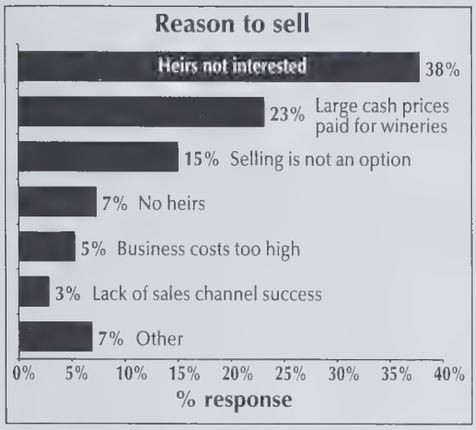
Reason to sell
Heirs not interested 38%
23% Large cash prices paid for wineries
15% Selling is not an option
7% No heirs
5% Business costs too high
3% Lack of sales channel success
7% Other
0% 5% 10% 15% 20% 25% 30% 35% 40%
% response

ing of this survey is that winery owners are unknowingly assuming both financial and execution risk by not starting the planning process now. There is a huge, disconnect in logic between the respondents expecting this change in control within the next 10 years, the fact that effective succession and estate planning takes five to 10 years to complete, and the statistical finding within the survey that only a minority of the industry's owners have a transition plan in place. Compounding that, most winery owners simply do not talk to their heirs about transition.

Planning for sale to a third party

Owners recognize that their winery is not just a retirement activity anymore, and in many cases, it represents their largest financial asset. But, while keeping the winery in the family is important, most would be willing to sell to a third party. Forty-five percent would take this option if their heirs don't reveal the aptitude or willingness to run the winery, or if they lack heirs to take over the winery.

An additional 23% say they have noticed the high sales prices being tossed around in the press. The adage that everything has its price would apply to this group, who note that it's hard to dismiss the possibility of a sale if the right price were offered. But once again, most have adopted a "wait and see what happens philosophy," with only 3% proactively planning the sale of their winery or positioning it for the highest return possible.

Based on the lack of planning revealed in the survey, we conclude that many owners who intend to sell will be disappointed in their winery's market valuation, largely due to poor planning. Selling a winery involves more than getting the financials together or running an ad in the newspaper. The process necessary to position a family winery for sale can take up to five years.

Issues that must be addressed in advance to keep them from delaying or stopping a sale or severely limiting sale proceeds include:

- Cleaning up financial records and practices (such as separating family cash flow from business);
- Taking steps to build more profitability into the winery (realigning product portfolio to include only the most profitable wines, which build equity);
- Realigning strategic and non-strategic assets against a plan (some winery assets may be separated from the assets for sale and set up to be sold piecemeal; some may be set up to be kept in the family);
- Solidifying key relationships (grape contracts, distribution, consultants, management team);

Confidentiality

The sale of a winery to a third party can impact several sensitive relationships, including distributor relationships, the management team, and suppliers (including grape suppliers). Premature news of a pending sale can severely impact current period sales, and availability of supplies. Working with the right M&A advisors, consultants, bankers, CPAs, and attorneys who have a track record of maintaining confidentiality during the sale process, is critical to the health of the winery as it goes through a sale, resulting in an optimum final price. ■

- Banking (loan agreements, covenants, prepayment fees, due-on-sale clauses);
- Tax planning (estate plan, an employee share option plan [ESOP], deal structuring, positioning other owners' assets for the best after-tax return);
- Licensing (Alcohol and Tobacco Tax and Trade Bureau [TTB], bounty, zoning ordinances, changes not grandfathered to the next owner); and
- Real estate (vineyards near the end of productive life, not planted to newer clones, inadequately positioned for the brand, seller's home on the property).

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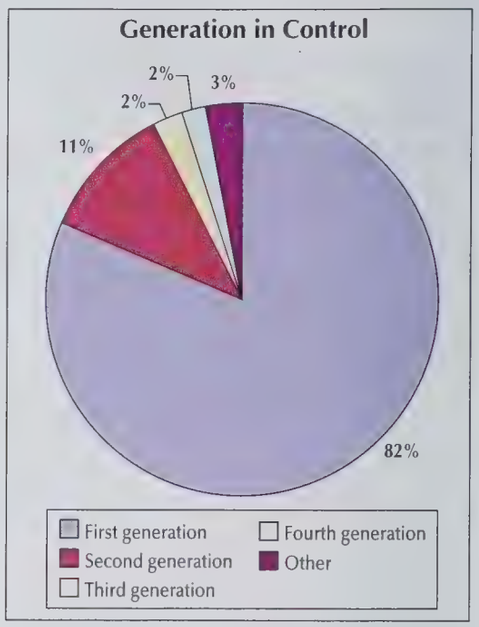
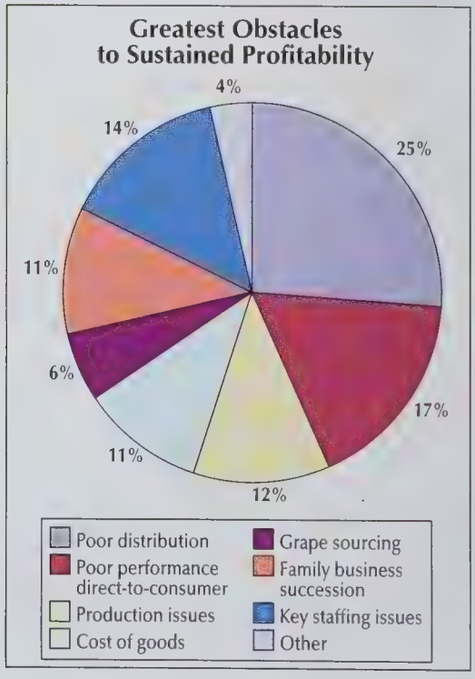


All of this and many other elements take time and proper consultation with experts to resolve for the best outcome.

Planning to keep it in the family

Most family wineries lack written strategic plans. Eighty-four percent said they do not have strategic plans and only 23% claim some kind of financial plan.[3] National studies show that business owners with written strategic plans tend to engage in other types of planning as well — practices that are essential to family-business survival and success.[4]



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For example, business owners in other industries are more likely to have buy/sell agreements, a formal redemption plan, and formal valuations of company share-value. They hold board of directors meetings more frequently, and the contribution of their boards is rated more positively.

Family businesses in other industries often involve more professional employees to run their businesses. There are qualification policies for employing family members, and they are more likely to have selected a successor. In addition, they post higher sales revenues and greater international sales. These findings support the relationship between the existence of a written strategic plan and taking actions that are correlated with family-business wealth preservation: success and survival.

Succession practices	In place
Advisors have been identified or are active in the process (CPA, attorney, merger/acquisition advisor, banker or family business advisor).	43%
Formal or less formal timeline for succession has been set.	28%
Financial plans are in place.	23%
Exit strategy completed, including estate/tax planning.	20%
Board of directors or advisors is in place.	18%
Strategic plans are in place.	16%
Family continuity plans are in place, defining family business policies.	16%
Clear roles and responsibilities in the transition have been reviewed and disclosed to everyone applicable.	15%
Outside board members are participating actively.	5%
Non-family spouses are aware of their roles in transition, and contracts exist that define those roles and ownership interests.	5%

If planning and communication are critical, why is no one doing them?

There are many reasons why planning is not done, but the survey results are quite clear: 77% of owners have no financial plan for a transition, and 80% have not completed estate planning. Of the owners expected to retire or semi-retire within 10 years, most have not chosen a successor (72% have no succession timeline articulated; 85% have not agreed to clear roles and responsibilities).

Why is planning not being done? Many hurdles are associated with family dynamics, personality, and hierarchy. We have seen founders who allow their heirs an opportunity to find their own voices in the winery, but cannot stop themselves from taking back control when decisions fall into areas in which they have less expertise, thereby stunting successor growth.

We have seen cases where current ownership has more than one heir working in the winery, but the founder

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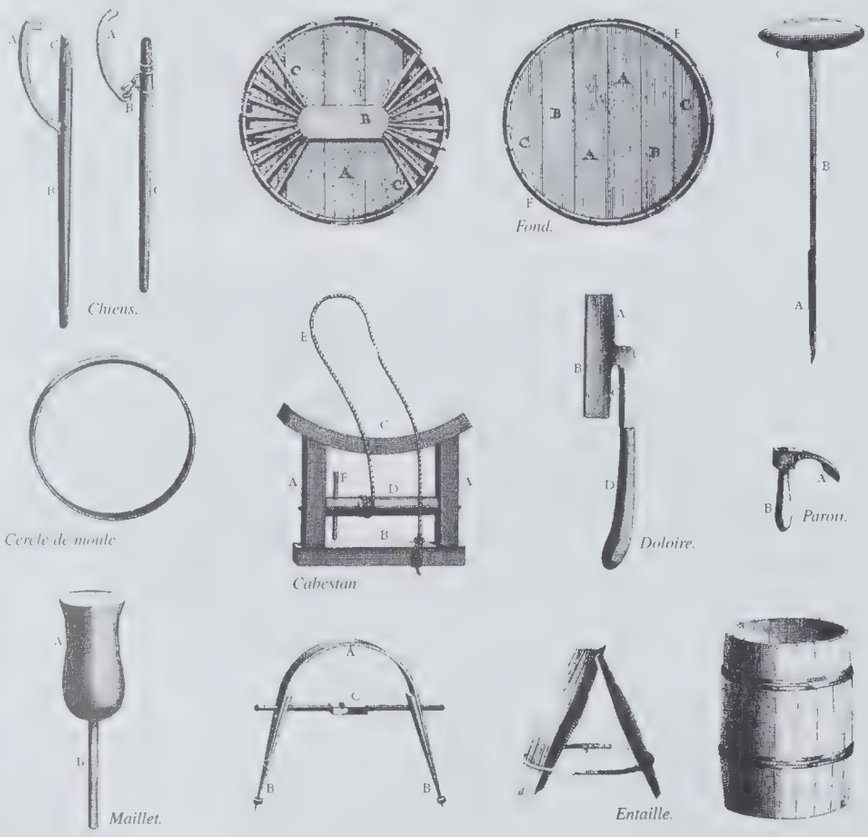

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will not select a CEO from among them, out of fear of showing favoritism. Never mind that none may be qualified to be the CEO.

This survey discovered that 84% of family wineries that expect to transition in the next five years have no policy regarding qualifications that family members must meet to be full-time employees of the winery. Neither do they have any type of family-continuity plan that delineates family policies.

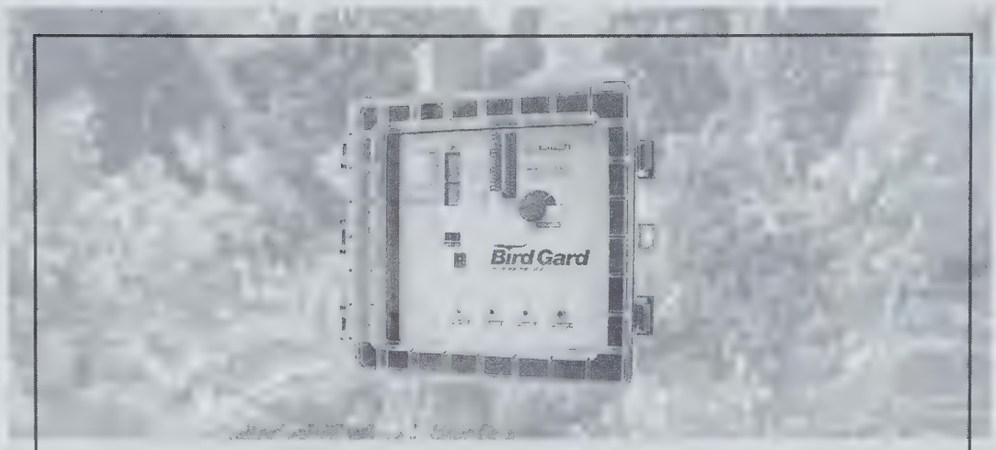
In one case, there is more than one heir working in the winery, but the future CEO will assume leadership only at the passing of the founder, and no one will learn who the new CEO is until the owner's will is read. While this sounds extreme, the survey reveals that other than knowing a will exists, 80% of significant stakeholders in these family wineries do not know what the senior generation ultimately intends to do with its shares in the winery.

This dearth of understanding can make it difficult for these wineries to anticipate capital needs for estate taxes and stock redemptions. The uncertainties over the senior generation's stock-distribution plans can also create significant confusion and friction between family members when the full extent of the plan is disclosed only upon the death of the majority owner — the time when family members are not only grieving, but are being tasked with tactical decisions they have not been prepared to tackle.

How to overcome obstacles to planning

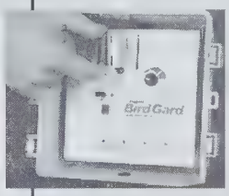
While family relationships and communication problems can impact the functioning and running of a family winery, there are common solutions that can be employed to both enhance relationships and improve the functioning of the core business asset for the present and the future.

Leadership and the use of family boards: Build stability and a long term approach — While the survey reports that the majority of owners want to see their heirs take the reins in the next five to 10 years, they reduce the heirs' likelihood of success by not planning or constructing a forum where important topics can be addressed. The forum most



"With many vineyards getting little grapes, a 3 acre section yielded 20 tons."

"After the horrible 2004 season, with many vineyards getting little or no grapes, a 3 acre section of riesling yielded 20 tons. Had the starling flocks been there, we would have lost $20,000-$30,000 worth of grapes." -Hazlitt 1852 Vineyards.



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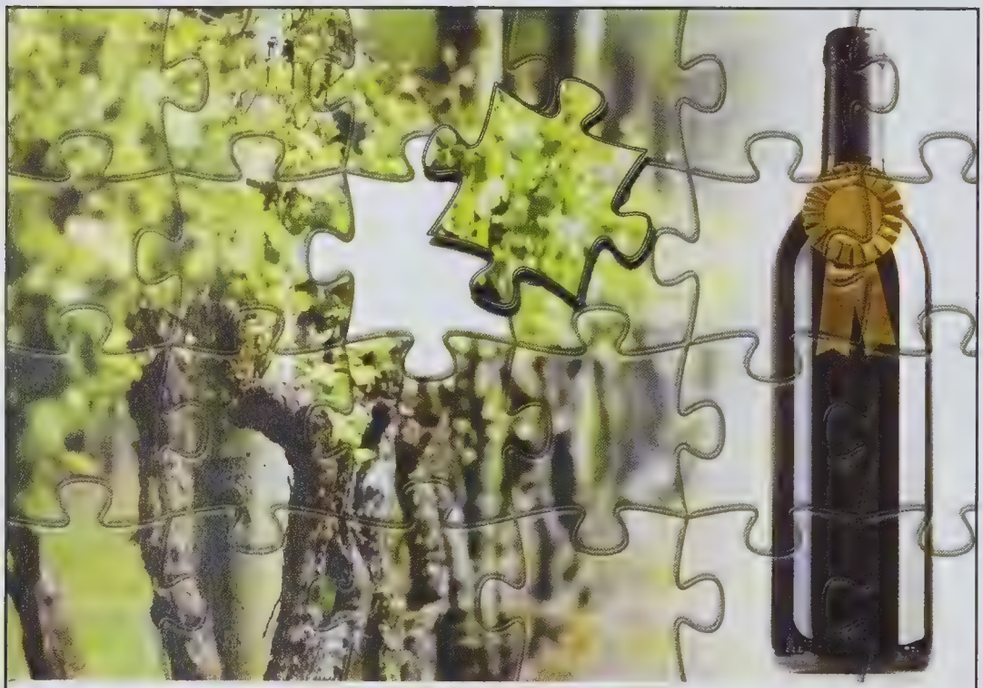
appropriate for these and other discussions is a formal advisory board or board of directors.

Alarmingly, only 28% reported having some form of board of directors or advisors. Fewer than 5% have outside board members participating actively in the governance process.

Why are so many wineries eschewing a board of directors? Experience teaches us that many founders of small businesses decided to start their own business, in part, because they have a strong preference for independence, so the thought of reporting to a board of any form may be entirely unappealing.



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But boards in a family winery, while typically existing to help drive strategic decisions, can be used in many ways to solve issues more unique to a family winery, such as assisting in successor selection; equity discussions amongst family members and generations; setting policies concerning family member compensation, performance reviews, career development, and hiring and firing; selecting a bridge CEO in the event of the sudden incapacitation of a key family employee; mediating dispute resolution; and as important, providing strategic input, guidance, and support.

Founders who want to transition their wineries to heirs need to implement board oversight early in the succession planning process. Often, the founder may see a board as an ideal solution for avoiding potential future pitfalls, but the independence trait of the founder may overpower the final decision. The mindset becomes "that's something that will be good after I'm gone."

The reality is that establishing a board is an essential early task in succession planning. Implementing a board function will require tinkering and adjustment. It's also important to demonstrate to heirs the owner's willingness to be accountable to a board and to be certain that the board fulfills the roles envisioned for it.

Boards are not one-size-fits-all for businesses. Wineries can chose to have a few key advisors who are competent professionals willing to coordinate with other advisors and address winery issues; they can create a more formal board of advisors that advises the winery but possesses no legal power; or they can establish a traditional, formal board of directors with advisory, legal, and fiduciary responsibility.

Beyond the board: Long-term wealth preservation is a question of family governance—As wine businesses move from a controlling ownership stage (single owner controlling decisions) to a group ownership by sibling- or cousin-owners, and as the winery gets more complex, it is important to consider new forms of governance (some structure that ties in all the communications and decision-making that

Continued on page 38

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SIGNIFICANT FINDINGS AT A GLANCE

The following key facts and figures were extrapolated from the survey to help provide context to our findings on current industry succession trends and practices. Statistics may not add up to 100% due to multiple possible answers to a question, due to responses in the "other" category (which are not reported here), or due to cross-tabulation analysis.

Inadequate planning could put next generation at risk

(total is more than 100% due to multiple responses)

Advisors chosen or active in planning	43%
Exit strategy/estate planning *NOT* completed (other than a will)	80%
Winery does *NOT* have a strategic plan	84%
Financial plan *NOT* developed	77%
Succession timelines *NOT* defined	72%
Clear roles and responsibilities *NOT* defined and disclosed	85%
Family continuity plans *NOT* in place	84%

Many respondents would consider sale to a third party

Would consider selling a controlling interest	36%
View their winery as an asset; would sell for the right price	16%
Prefer the family to continue to control the family winery	40%
Other	8%

WHAT IS DRIVING RESPONDENTS TO CONSIDER SELLING?

Heirs not interested in the winery, or lack of heirs	45%
Large cash prices being paid for wineries are hard to ignore	23%
Selling is not an option	15%
Cost of managing the winery, or poor performance	8%
Other	9%

Most respondents are first-generation wineries

First generation/founders	82%
Second generation	11%
Third generation	2%
Fourth generation	2%
Other	3%

Respondents have little experience with strategies, practices, or case studies of successful transitions

Wine families who have never been through a change in control	78%
Have been through a change in control (last five years)	11%
Have been through a change in control (more than six years ago)	11%

Adequate family communications

Last time future ownership was discussed was under one year	48%
Last time future ownership was discussed (1 to 2 years ago)	19%
Never discussed	33%

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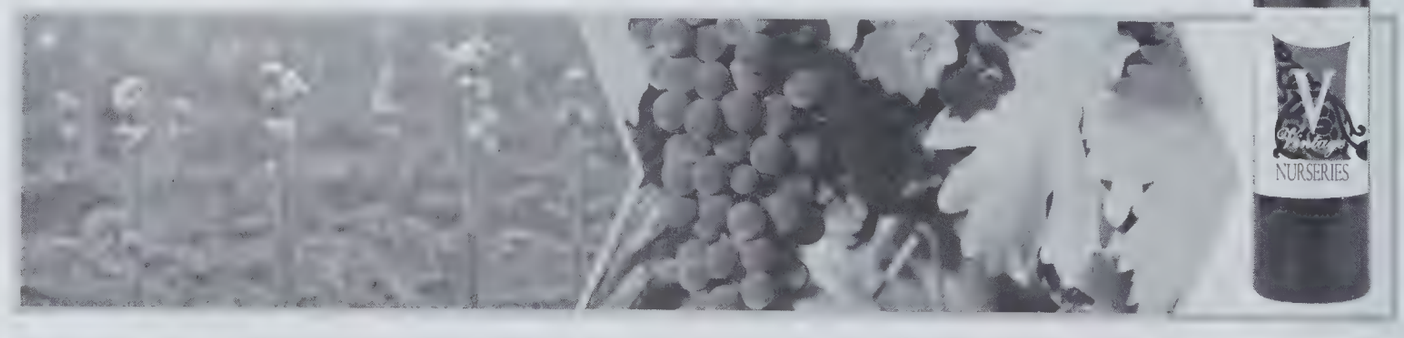

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Few wineries have a functioning board of directors

For wine families facing change of control within ten years:

Have a board of directors or advisors	18%
Do NOT have a board of directors or advisors	81%

WHEN THEY HAVE A BOARD, THE CONTRIBUTION IS LIMITED (TOTALS LESS THAN 100% DUE TO MULTIPLE RESPONSES)

Have outside directors	5%
Directors drive winery strategy and decision making	17%
Mentoring the next generation	7%
Mediating family and inter-generational differences	6%
Driving policy, performing control and governance	<5%

Respondents trending to professional managers

Family winery currently run by a non-family member	20%
Family winery currently run by a family member	80%

CONSIDERATION OF A NON-FAMILY MANAGER

Willing to consider a non-family manager	56%
NOT willing to consider a non-family manager	44%

HOW NON-FAMILY MANAGERS ARE COMPENSATED

Salary only	10%
Salary plus bonus	49%
Long-term incentives such as stocks, phantom stock or life insurance	21%
Other	20%

Many owners expect a change in control

Within 10 years	51%
Within five years	22%
In more than 10 years	49%

WHAT IS DRIVING THE EXPECTED CHANGE IN CONTROL?

Next generation will be ready	47%
Estate/tax planning needs of key owners/investors	16%
Owners need liquidity	13%
Owners no longer have the time/energy now required	9%
Other	15%

Many respondents are small wineries

Under $3 million in annual revenue, less than 8,000 cases

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Ownership transitions

Continued from page 34

need to happen among the three essential circles of people that make up the business: family members (family council), business owners (board of directors or advisors), and the business team.

Fundamentally, the precise form of governance can range from informal to very formal. The bottom line is that it needs to define the participation level, roles, and commitments of all three circles that ultimately provide a balance of problem-solving and oversight. Successful governance is achieved best when decisions are made by consensus without having to move to a vote.

Use of non-family managers: Build a performance culture — Successful family wineries will outperform their competition by instilling a performance culture. A performance culture is one in which the company's shared values, beliefs, and practices align to have the greatest positive impact on individual and organizational performance.

There are three highly-interrelated performance culture categories that have a direct impact on the execution of business strategy:

1) Shared direction and love for the winery,
2) Persistent performance execution, and
3) Focus on developing both human and financial capital.

As wine businesses move from the first generation to the next, they will need to develop a performance culture to survive and thrive. This can sometimes be nurtured from within the family or sometimes by hiring non-family managers who already have expertise and knowledge.

This strategy can help combat a common issue for a family in transition — an heir unable, unwilling, or unqualified to run the family winery. At times when the heir may not be ready, or simply needs mentoring and experience before taking the family-winery reins, a non-family CEO can serve as a bridge (bridge CEO) between current and next generation family members.

Because the wine industry has been so family-centric, it's not surprising that relatively few family-owned wineries (20%) have hired persons outside the family for CEO positions. One reason is obviously financial. A small family winery may not make sufficient profit after debt service to provide a CEO's wage.

But because the wine industry is changing so rapidly in so many other areas, the majority of owners say they are open to hiring non-family members to run the winery either now or when they are ready to retire if no family member is ready or willing to become the CEO. It should also be encouraging to a winery owner to hear the generally positive anecdotal evidence we have collected

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from those who have hired non-family members to run their businesses.

Conclusion

Succession is not what happens once you are gone. The strategic objective of succession planning is family wealth preservation — to settle a variety of complex issues concerning the family winery by defining the guidelines and rules affecting this transition, such as identifying and grooming a successor; determining how to treat family members who are not involved in the winery; and ensuring sufficient liquidity to pay taxes and other expenses.

A family winery's ability to remain in business over a long period of time most often comes down to excellent long-term succession planning, regardless of how successful the family is financially. Tactically, a well-executed plan makes the main decision maker redundant well before a successor assumes complete control.

In this era of change in the family wine business, this type of planning, while functionally difficult to execute, is nevertheless critical for long-term survival. Those wineries that embrace the concepts presented here will have a stronger likelihood of successfully meeting their own goals and long-term vision. ■

APPENDIX

Family wine business profile

We estimate that the average survey respondent's annual revenues are $3 million and volumes are 8,000 cases (Calculation assumes 65% sold at average $15/bottle FOB, and 35% sold at average $30/bottle MSRP) . Range in volume varies broadly; 10 wineries report producing more than 100,000 cases. Overall, 70% of the wineries report volumes of under 10,000 cases.

SVB Silicon Valley Bank's 2006 Peer Group Analysis (A proprietary program that averages all of SVB Silicon Valley Bank's wine clients' financial statements) suggests that wine businesses make an average 12% after-tax profit. The biggest challenge for these small wineries is being able to afford the cost of the high caliber professional resources necessary to navigate their family businesses through a successful succession transition. Their ability to invest in knowledgeable family business advisors is fundamental to managing the risk around their family assets during complex transitions. Coupled with the fact that most winery owners have never been through a change in control, they risk underestimating the cost of the transition, which can run into hundreds of thousands of dollars in industry services, and the amount of time needed to complete succession.

Survey methodology

The survey team polled a comprehensive group of family wine businesses in California, Oregon, and Washington. The online survey contained more than 20 questions, and was mailed in October 2007 to 2,921 family winery owners, CEOs, presidents, and general managers. 1,510 e-mail surveys were opened. The response rate was 18%, with 271 surveys being completed within a 15-day period. 92% or 247 of these qualified as family-owned respondents.

About Scion Advisors

A business advisory group, Scion Advisors is committed to helping wine family businesses prepare for the future. Scion Advisors work alongside winery owners to develop the plans and structures to navigate important business transitions. The Scion approach has enabled clients to manage family business succession, derive new sources of profitable growth, and reposition their assets to build higher value. Scion Advisors is comprised of seasoned executives who have worked across 100 companies and several industries — they understand what works and what doesn't in different situations, enabling them to get at the heart of things faster. Driving better solutions that achieve higher levels of performance and long-lasting results, Scion Advisors has successfully guided clients through a broad range of family business issues. Find further information at www.scionadvisors.com.

About SVB Silicon Valley Bank's Wine Division

SVB Silicon Valley Bank's Wine Division has a large team of commercial bankers dedicated to the wine industry. It specializes in commercial banking for premium wineries and vineyards and the industries that support them. Its Wine Division opened in 1994 and has offices in Napa and Sonoma counties serving 350 clients. The Division continues to grow its client base in Napa, Sonoma, and the Central Coast of California and in Oregon and Washington. Wine Division employees are 100% dedicated to the wine industry, enabling the company to consistently support its clients through economic and growth cycles. By virtue of its dedication to the wine industry, SVB Silicon Valley Bank helps make clients more successful by providing counsel on many aspects of their winery's business, beyond traditional banking services. More information can be found at www.svb.com.

The preceding data were created expressly from this survey and focused on identifying individual wineries and wine companies on the West Coast of the U.S. A special thank you to Christian Miller of Full Glass Research for determining the statistical significance of the data.

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Winery characteristics

77% of the 247 survey respondents are single majority owners, while 16% are people who have limited ownership in the winery. The remaining 6% are non-family executives who have no ownership today and either no hope for future ownership or hope for some level of future limited minority ownership. 80% of respondents reported being from wineries where the majority owner runs the business; another 11% are running the winery and identify as a family member who is a minority owner or non-owner. Only 6% of respondents were non-family member CEOs of family-owned wineries.

Significance of data

Potential survey biases include the following, but are deemed to have little relative impact on the outcomes of our report:

1. **Geographic bias** — The ratio of California winery respondents as compared to Oregon and Washington wineries looks reasonable. (The *2004 California Economic Impact Report* counted 1,049 "bricks + mortar wineries." The *2005 Oregon Economic Impact Report* by Full Glass Research counted 247 wineries. The *2001 Washington Economic Impact Report* counted 160 wineries.)

   a. Respondents come from the following geographical locations: California (129); Oregon (24); Washington (20), Other (94 did not identify, but are probably from CA, OR, or WA).

2. **Winery size bias** — Respondents trend slightly toward smaller volumes, which would bias the number of first generation wine business owners who responded to the survey.

   a. 80% of respondents run wineries less than 25,000 cases compared to 69% of wineries overall (in a 2005 ZAP Producer Study) and compared to 71% of wineries overall (in a 2004 California Economic Impact Report).

   b. 14% run wineries between 25,000 and 100,000 case production compared to 8% of wineries overall (2005 ZAP study) and compared to 17% of wineries overall (California Economic Impact Report).

   c. 4% run wineries of more than 100,000 case production compared to 7% of wineries overall (2005 ZAP study) and compared to 11% of wineries overall (California Economic Impact Report).

3. **Incentive bias** — Respondents are people who are more interested in transition issues.

   a. Respondents were offered a copy of the survey data as compensation and are therefore people who are more likely to be interested in the transition issue.

   b. The number of respondents anticipating ownership change in control in the next 10 years may be overstated at an industry level.

   c. However, comparisons within our sample are not affected (types of transitions or measures of preparedness).

4. **Timing bias** — Timing of the report (at the end of 2007 harvest) could unfavorably bias the survey toward wineries where the decision maker is not the winemaker.

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MARKET TRENDS

Does California have the capacity to compete in 2010?

BY George M. Schofield

What will be the vineyard capacity and related ability of the California wine industry to grow in the foreseeable future? Analysis of these issues focuses on wine demand and growth trends in an effort to perceive segments where strain is likely to occur.

The estimated annual percentage changes in wine demand for the U.S. wine market for the years 2001 to 2006 are shown in Table I. During this period, and in previous years, the market for generic wines experienced negative growth. Obviously, no capacity limitations exist in this sector, which accounts for 24% of unit sales volume.

The market for varietal wine sales in the U.S. market is far more healthy, averaging +5% annual growth and experiencing an upward trend from 2004 to 2006. While this overall average includes the strong performance of imports, it also includes the depressing effect of the negative (–1% to –3%) growth of White Zinfandel. This chronically weak sector, representing 8% of sales volume, portends no capacity problem.

In the remainder of the varietal wine segment, three main grape varieties — Cabernet Sauvignon, Chardonnay, and Merlot — represent more than 42% of total case sales volume and almost 60% of total sales dollars in the U.S. market.

Coming out of the 2000 mini-recession and the 9/11 backlash, unit sales for Cabernet Sauvignon exhibited steady annual growth from 6% to 10%. Meanwhile, Chardonnay was experiencing stable 5% annual growth. Merlot, coming off of strong double-digit growth in the 1990s, suffered, in 2005, from the disparaging remarks made by the lead character Miles in the notorious *Sideways* movie.

Although Cabernet Sauvignon continued to show accelerated annual growth in 2007, probably in the 12% to 13% range, this rate is not sustainable. Future growth is likely to taper off to about 6% to 8% by 2011. Merlot should continue to recover from its *Sideways* debacle and level off at 5% to 6% annual growth, just slightly above the predicted 4% annual growth for Chardonnay.

This framework of historical and future sales demand paves the way for a detailed analysis of the supply picture. Cabernet Sauvignon will be used as an example of the factors affecting the supply of the top grape varieties, and of the methodology used to analyze and predict that supply.

From 1997 to 2000, a significant increase in new plantings occurred (Table II). A waning occurred in 2001, with plantings flattening out in the next five years. When removals are factored in, net new acres of California Cabernet Sauvignon were essentially zero between 2001 and 2007.

Table II also shows projections of annual total acres, plantings, and removals of California Cabernet Sauvignon out to 2011. Virtually nothing is anticipated to happen in the short term, with some minor planting beginning in 2010.

The last significant plantings (in 2000 and 2001), are now fully mature (Table III). With no further planting over the past five years, there is essentially nothing to mature in the next four years and little can change this. Just as the production years 2001 through 2005 benefitted from the plantings of the 1990s, so too the next five years will suffer from the absence of significant new Cabernet Sauvignon vineyard development from 2002 through 2007.

Vineyard capacity has another dimension — productivity or expected yields. Although yields per acre do vary considerably annually, they are predictable over a seven-year cycle. Table IV depicts the yield history over the past seven years (2000 to 2006).

The year 2000 represents the high and 5.2 tons per acre of 2004 represents the low (21% below normal). In fact, four out of five of the last years have been below normal, not counting the 2007 harvest, which is likely to be slightly below normal.

Table V takes the projected Equivalently Mature Acres for future years

Table I: Estimated Growth Rates, California Wines *

Year	Cabernet Sauvignon	Chardonnay	Merlot	Total varieties	Generics
2001	+3%	+3%	+3%	+3%	–6%
2002	+6%	+5%	+11%	+5%	–2%
2003	+5%	+6%	+6%	+5%	–2%
2004	+7%	+5%	+5%	+4%	–3%
2005	+8%	+5%	0%	+5%	–3%
2006	+10%	+5%	+3%	+6%	–3%
2007 (Estimated)	+12%	+3%	+5%	+7%	–4%
2008 (Projected)	+8%	+ 4%	+6%	+6%	–3%
2009 (Projected)	+7%	+4%	+6%	+6%	–3%
2010 (Projected)	+6%	+4%	+5%	+5%	–3%
2011 (Projected)	+6%	+4%	+5%	+5%	–3%

*based on sales volume

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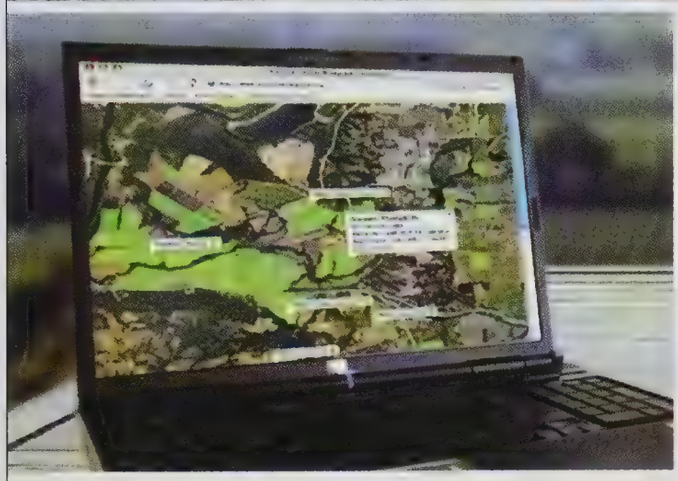

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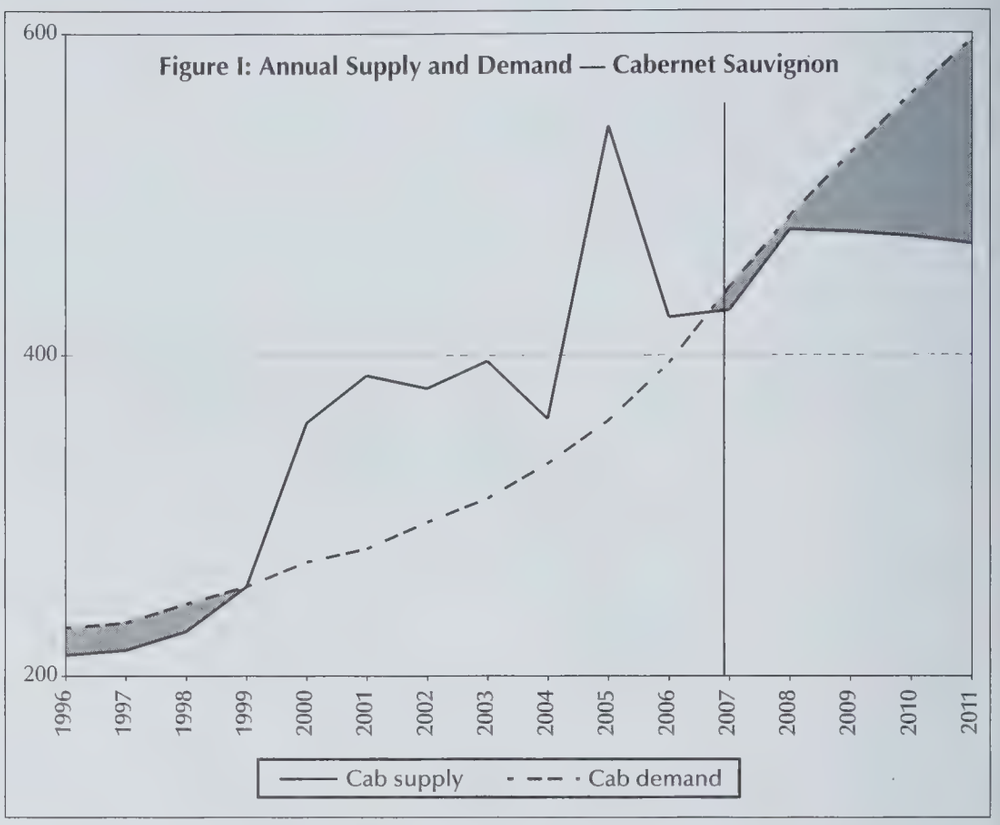
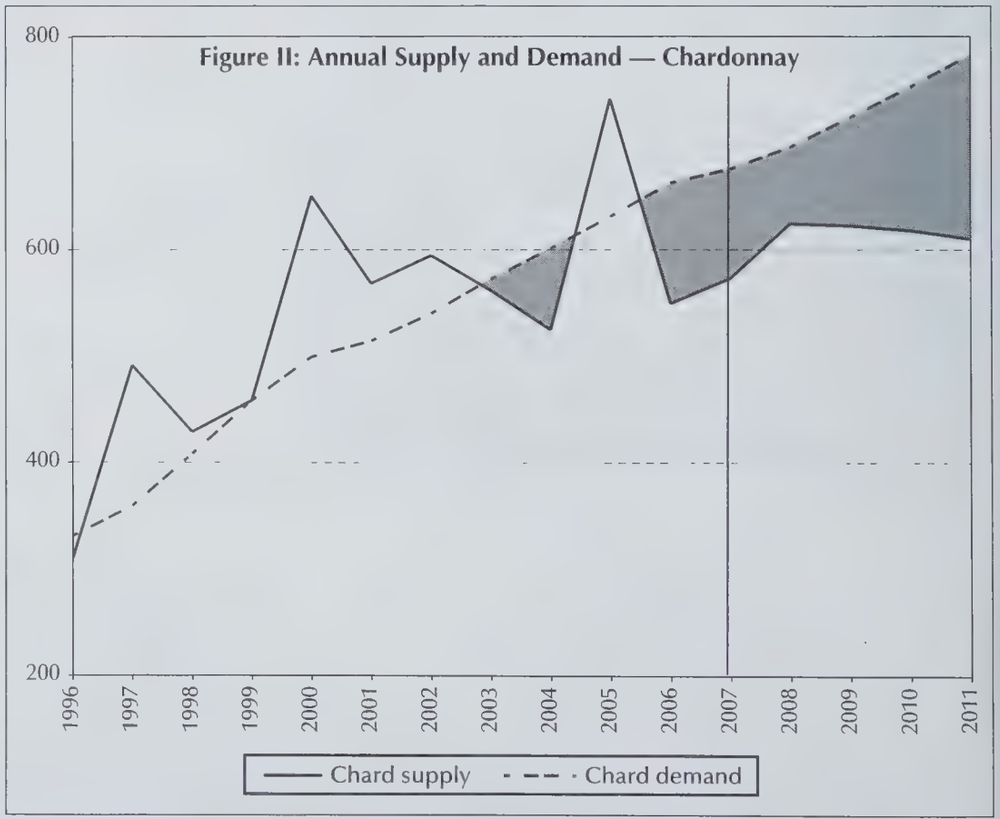
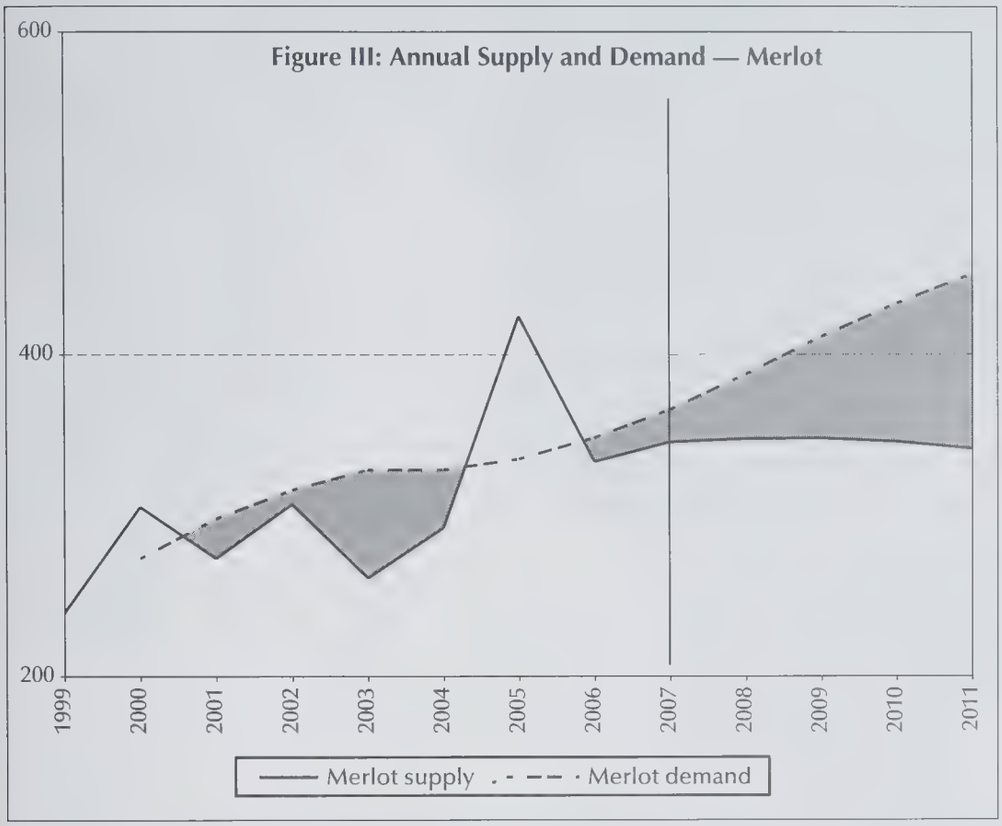


out to 2011 and multiplies it by adjusted "normal" production. Adjusted normal is used because the historical 6.6 ton-per-acre average will be reduced to 6.3 tons per acre by a regional shift caused by most of the recent planting being in the lower yielding coastal areas and the removals occurring in the fertile interior regions.





The overall result is flat, if not slightly declining: total California Cabernet Sauvignon production in the range of 475,000 tons per year for the foreseeable future. This will vary year-to-year, probably in a range of plus or minus 20%. History proves over cycles of seven years that grape yields by region and variety are remarkably consistent. On this basis, an average annual 475,000-ton production for Cabernet Sauvignon through the year 2012 is a reasonable projection.

The year 2007 is a likely critical turning point that has not been widely perceived because of cumulative surpluses of prior years. Annual supply and demand came close to balancing in 2007 mainly because of a short crop. This annual balancing will likely repeat in 2008 for a different reason — growth in demand without new capacity.

Going forward, assuming normal production, we are essentially out of normal growth potential for California Cabernet Sauvignon grape production.

Table II: California Cabernet Sauvignon, Plantings and Removals

Year	Total acres	New plantings	Removals	Net new acres	Percentage increase, total acres
1999	68.0	8.1	–1.1	7.0	—
2000	74.1	7.7	–1.6	6.1	9.0%
2001	77.3	4.7	–1.5	3.2	4.3%
2002	78.4	2.8	–1.7	1.1	1.5%
2003	78.6	1.4	–1.3	0.2	0.2%
2004	77.9	0.7	–1.5	–0.8	–1.0%
2005	78.0	0.5	–0.3	0.2	0.2%
2006	77.6	0.4	–0.8	–0.4	–0.5%
2007 (Estimated)	77.4	0.4	–0.5	–0.2	–0.2%
2008 (Projected)	77.5	0.6	–0.6	0.1	0.1%
2009 (Projected)	77.8	1.1	–0.7	0.3	0.4%
2010 (Projected)	78.8	2.0	–1.0	1.0	1.3%
2011 (Projected)	80.4	3.0	–1.4	1.6	2.0%

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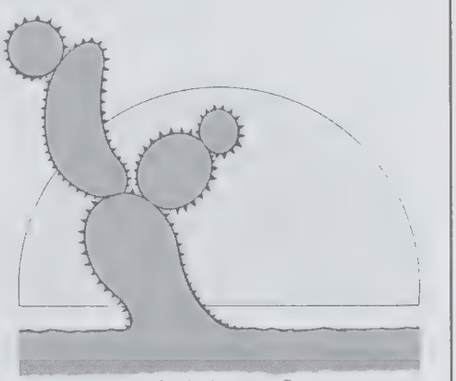

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Table III: California Cabernet Sauvignon, Vineyard Production Capacity

Year	Total acres (000)	Equiv. mature acres (000)	% Maturity	% Increase equiv. acres
1999	68.0	39.5	58%	11%
2000	74.1	44.9	61%	14%
2001	77.3	51.9	67%	16%
2002	78.4	58.9	75%	13%
2003	78.6	65.1	83%	11%
2004	77.9	69.5	89%	7%
2005	78.0	73.3	94%	5%
2006	77.6	74.8	96%	2%
2007 (Estimated)	77.4	75.6	98%	1%
2008 (Projected)	77.5	75.8	98%	0%
2009 (Projected)	77.8	75.5	97%	0%
2010 (Projected)	78.8	75.0	95%	–1%
2011 (Projected)	80.4	74.2	92%	–1%

Table IV: California Cabernet Sauvignon Production and Yield History Years 2000–2006

Year	Tons crushed (000)	Equiv. mature acres (000)	Yield tons/acre	Annual variations from "normal" above	Annual variations from "normal" below
2000	358	44.9	8.0	21%	—
2001	387	51.9	7.5	13%	—
2002	379	58.9	6.4	—	–2%
2003	396	65.3	6.1	—	–8%
2004	360	69.5	5.2	—	–21%
2005	542	73.3	7.4	12%	—
2006	424	74.8	5.7	—	–14%
Historical average for seven years (2000–2006)			6.6		
Future average adjusted for recent plantings			6.3		

Even if plantings occur in 2008 or 2009, significant relief is four to five years away. After 2008, increasingly larger annual shortages are likely.

However, the short- to medium-term buffer may be the current large carry-forward of California Cabernet Sauvignon inventory from prior vintages, especially bulk wine from the 21% above-normal 2005 vintage. This may delay the advent of real cumulative shortages to 2010 or later.

The real question is how long will it take rising demand to consume the

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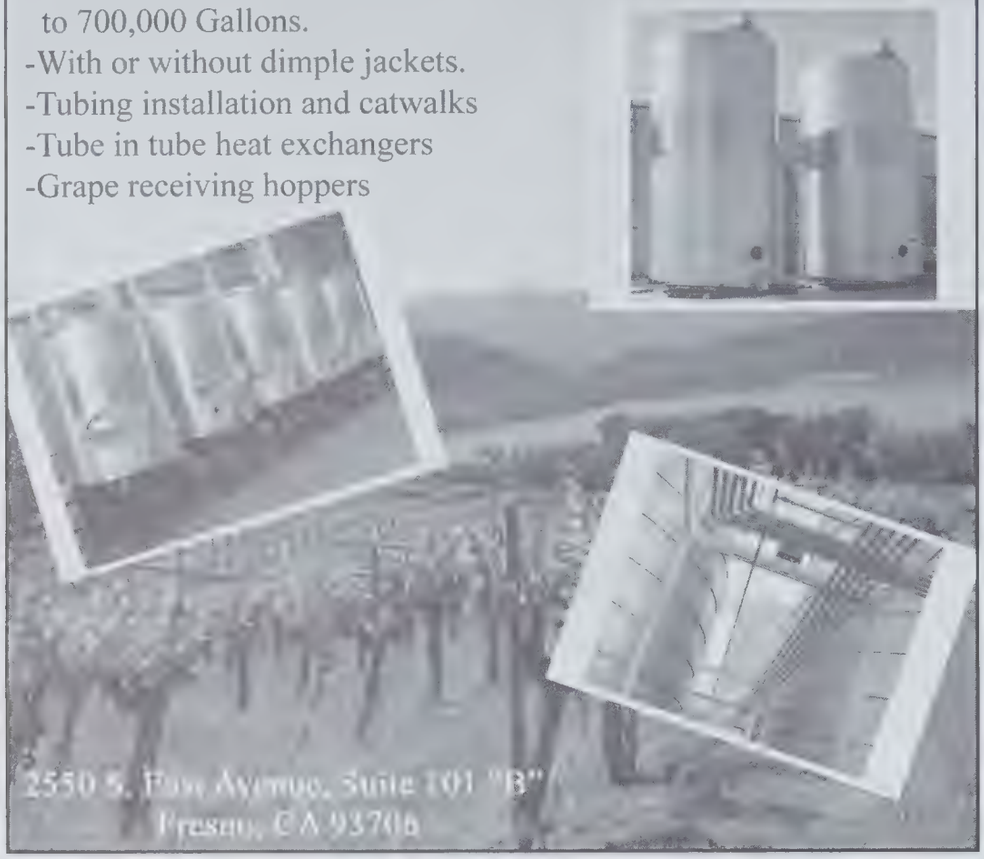
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Table V:
California Cabernet Sauvignon
Projected "Normal" Production

Year	Equiv. mature acres (000)	Tons crushed (at 6.3 tons/acre)	Harvest adjustment	Revised projected tons (000)
2007 (Estimated)	75.6	478	–50	478
2008 (Projected)	75.8	479	—	479
2009 (Projected)	75.5	477	—	477
2010 (Projected)	75.0	474	—	474
2011 (Projected)	74.2	469	—	469

large carry-over of surplus bulk wine. This, in turn, begs the question of the size of the surpluses by variety:

For Cabernet Sauvignon it may be considerable.

Merlot could be less in magnitude. However, demand is not nearly as strong.

For Chardonnay, the answer appears to be little surplus that will diminish quickly as a reaction to the relatively short 2007 crop.

Overall, it appears that the current capacity of California vineyards to produce Cabernet Sauvignon is about 475,000 tons and this level is fairly close to the estimated level of demand for the year 2008. However, there is currently little ability, short of an above-normal crop, and except by using wine inventory from prior harvests, for California vineyards to meet rising demand.

At some point over the next few years, demand will have to be satisfied by other sources, such as imports, or demand will be curtailed.

A picture is truly worth 1,000 words. Figure I is a graphic representation that clearly depicts the overall situation relative to the current and future balance of California Cabernet Sauvignon grapes.

Note the small shortage in the years 1996 to 1999, followed by the seven years of large surpluses from 2000 to 2006. This created a cumulative wine surplus of 600,000 tons or 100 million

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gallons, some of which influences the market today.

There are growing projected annual deficits beginning in 2009 in Figure I. Again, be careful, as normal crops are assumed. Obviously, if there is another yield like that in 2005, we could be quickly back into surplus. But what happens if a significant short crop occurs first? The answer is considerable scurrying for grapes.

Without presenting all the detailed calculations, Figure II shows the picture for Chardonnay. The impact of the shortage in 2004 was covered by the prior years' cumulative surpluses. The large 2005 crop again renewed the psychology of ongoing surpluses. Below-normal crops in 2006 and 2007 have fairly well-balanced Chardonnay supply and demand. With no future capacity gains and demand growing at 3% to 4%, it is probably only a matter of time until a real pinch is felt.

Merlot is slightly different (Figure III), but with the same long-term prediction. Recovery may not be evident yet because of surplus wine, but rising demand and flat capacity will likely cause shortages sooner rather than much later.

Conclusion

Overall, the differences between the three main grape varieties are not great. The individual future scenarios for each grape variety may display different time patterns and the magnitude of predicted results may vary. However, with all three grape varieties, the prognosis is similar.

After depletion of current wine surpluses, there will far more likely be a short California vineyard capacity for premium varietal grapes than long. The specific timing may be uncertain and will depend on Mother Nature. However, when it does occur, reaction is likely to be swift and include:

- A scramble for grapes,
- A step-function increase in prices,
- Wine allocations as growth is restricted. ■

(The above text is an abstract of a speech given at the Unified Wine & Grape Symposium, January 29, 2008.)

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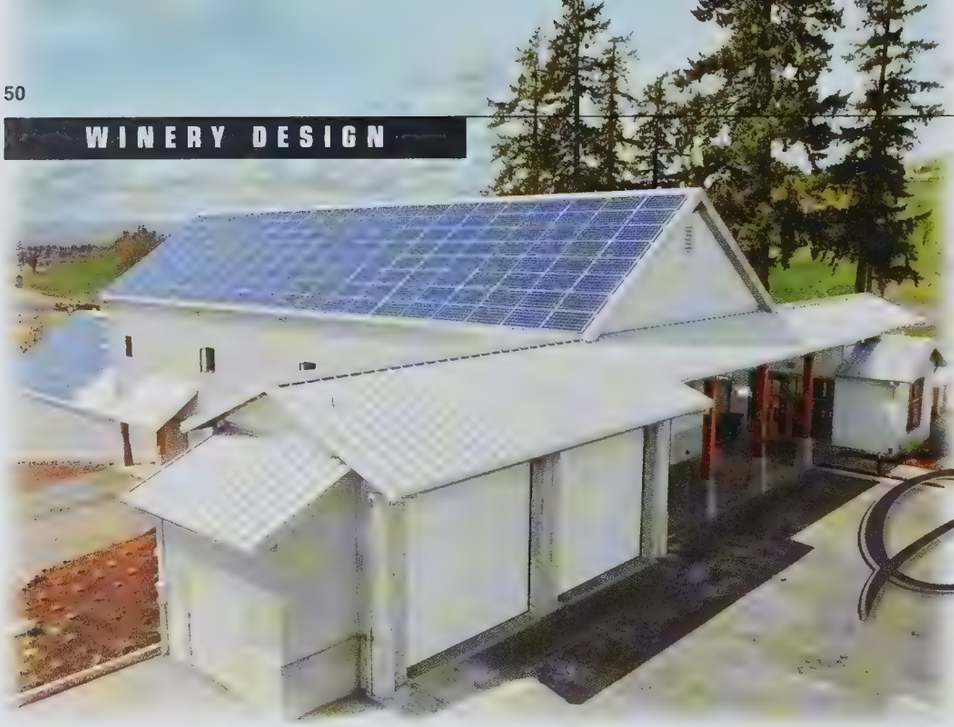

Stoller high-tech achieves small ecological footprint

BY Ernest R. Munch, Architect
Portland, OR

Environmental consciousness and wine quality were given equal emphasis in the design of the winemaking facility at Stoller Vineyards, in the Dundee Hills of Yamhill County, Dayton, OR. The state-of-the-art building was designed to be a "high-tech barn" in harmony with its surroundings, while integrating function with environmental sustainability. As a result, it became the first complete winery in the U.S. to be LEED-certified at the gold level.

LEED (Leadership in Energy and Environmental Design) is the green building rating system of the U.S. Green Building Council. It is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings.

Based on well-founded architectural, construction, and environmental standards, LEED emphasizes advanced strategies for sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. Creating a LEED gold-level winery requires the entire project team to work together, integrating design and construction beyond normal practices.

My working relationship with Bill Stoller (owner) goes back 12 years, when Harry Peterson-Nedry (Chehalem Vineyards, Newberg, OR), introduced us after Stoller acquired a 373-acre family turkey farm. The site had been long admired by some Oregon pioneering vintners for its south-facing slopes of largely Jory soils. Stoller's vision was to create a vineyard and high-end winery that could sustain future generations of his family.

There were turkey sheds and a grain elevator on the Stoller property. Initially, we considered whether there might be some way to incorporate them into the winery design. The sheds, however, proved too insubstantial and too difficult to adapt to Stoller's long-term vision.

We designed the Stollers' residence first, placing it on the location of the original farmstead. As the home was being built, we continued talking about the idea of building a winery that would incorporate current ecological design strategies. We continued to search for the best winery site on the property, as vineyards replaced turkey sheds.

My firm had designed several Oregon wineries, including Domaine Drouhin Oregon, Willakenzie Estate Winery, and Domaine Serene, all of which used gravity to assist in the gentle production of Pinot Noir. Peterson-Nedry advocated for a full gravity-flow facility for the Stoller Winery.

Stoller wanted to go even further into the world of sustainable practices and place the lowest possible stress on the environment. Solar energy, ecological waste treatment, and an expanded use of recycled materials were all important elements in getting Stoller's winery LEED-certified.

In 1998–1999, we focused our efforts on a knoll in the southeast corner of the property that was an appropriate distance from the residence, and that offered a gentle slope for a gravity facility. It had a south-facing exposure for collection of solar energy, room for expansion, views back to the vineyards and of Mt. Hood, and a small stand of fir trees that would preserve the profile of the hill after the winery was built.

Stoller's idea was to create an agrarian building that would, from a distance, relate to the group of existing farm buildings. Inside, it would offer a high-tech surprise, capable of producing world-class wine. All of this would be interpreted under the umbrella concept of long-term sustainability, confirmed by LEED certification.

In order to achieve LEED certification, all processes involved in winemaking, from production and long-term ageing to personnel and the site location's microclimate, had to be considered. Every aspect of the winery, from harvest to shipment, affects the design strategy in some manner — often in ways that are not easily anticipated.

As LEED-certification is a third-party verified process, it requires documentation to demonstrate compliance

Red fermentation room has a urethane-modified concrete (UMC epoxy floor coating system) 1/4-inch coating that withstands high temperature changes (such as pressure washing with very hot water) and has similar expansion and contraction rates as the concrete structural floor. A custom-designed sorting-hopper with adjustable conveyor feeds grapes to the destemmer, which sits on rails positioned above the tanks. The entire system can move to feed any of 22 open-top tanks.

in six areas: Sustainable Site, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Inno vation and Design Process. This required that the design team make an upfront effort, documenting how the design would achieve LEED credits, and how they were achieved, from material acquisition, through the construction processes, to commissioning of the building and its systems.

Corey Omey (project manager) implemented sustainable features and maintained detailed records by working with the contractor and consultants throughout the process.

Design, construction, and implementation of the eco-conscious facility were team efforts, with input from a variety of sources: Ralph DiNola and Nina Tallering of Green Building Services Inc. (Portland, OR), who performed LEED consulting services; Consultech NW, mechanical engineering consultants; Cundif Engineering, electrical engineers; Pacific Lightworks, lighting design; KPFF, structural engineers; Walker Macy, landscape architects; Bainbridge Associates,

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interior designers; Reimers and Jolevette, general contractors; Dynaelectric, which provided solar power engineering and installation; and Stoller Vineyards management and staff.

Minimizing the winery's carbon footprint was a primary goal, and included two aspects — energy conservation, and harvesting as much energy from the site as practical. Protecting natural resources and minimizing the need for energy that is traditionally produced by fossil fuels was the basis for the design. To achieve this, the facility combined a variety of environmentally-conscious construction and production practices, including:

Building orientation — Placement of the building on the site was an important initial decision that affected the type and amount of energy consumed. The building was given an east-west orientation that stepped down a hillside, with a large south-facing roof, ideal for solar generation, and access to all process levels that were involved in gravity production. The building protects the interior activities from the prevailing southwest storms, while providing natural lighting and ventilation.

Solar energy generation — The south-facing roof contains a 45 kW photovoltaic array, which produces 40% to 50% of the building's electrical needs. The direct current (DC) power generated by the 224-solar-module array goes into seven Sunny Boy 6000 inverters, which convert DC power to alternating current (AC), utility-grade power.

The system is rated at nearly 40,000 AC watts in peak sunlight conditions, and provides approximately 52,000 kilowatt-hours of clean energy per year. The solar array is tied to the Portland General Electric grid and effectively uses it as a battery. In peak periods, the winery draws extra electrical energy from the grid. During off-peak periods, excess power is sent to the grid, essentially running the meter backward.

Conservation of electricity — A computer-generated energy model calculates that the Stoller Vineyards winery performs 74% better than a building designed to meet Oregon Energy Code required minimums, because of energy-efficiency measures employed in the design. This was accomplished by adding insulation; specifying energy-efficient equipment, appliances, and lighting; placing windows and sun control to minimize solar heat gain in the summer; making use of natural ventilation; and using gravity in the winemaking process.

The winery location on the top of a knoll provides the slope required for gravity flow of the wine. Gravity flow eliminates most of the need for pumping wine, thus improving wine quality while conserving energy.

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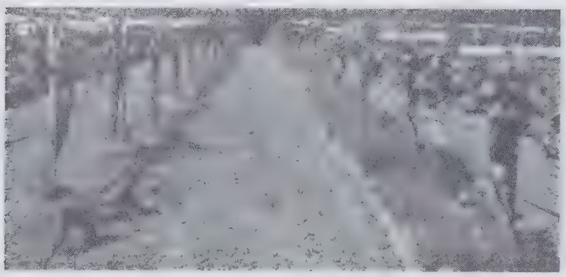

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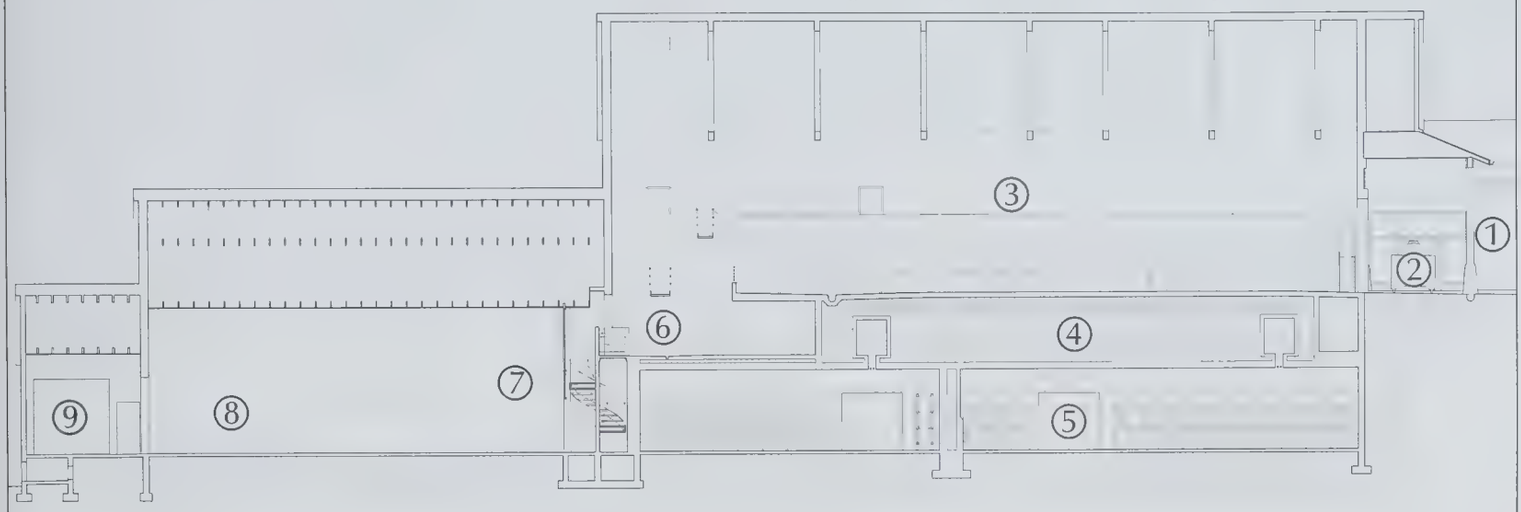
Cross-section of Stoller Winery multi-level building shows gravity-flow winemaking.



① Harvest yard; fruit enters facility
② Wine press
③ Fermentation tanks
④ Catacombs and cooling mass
⑤ Barrel rooms, cellars
⑥ Settling and blending; tank level
⑦ Gravity-feed wine pipe from blending tank to bottling line
⑧ Bottled wine ageing and storage
⑨ Loading dock; wine leaves facility

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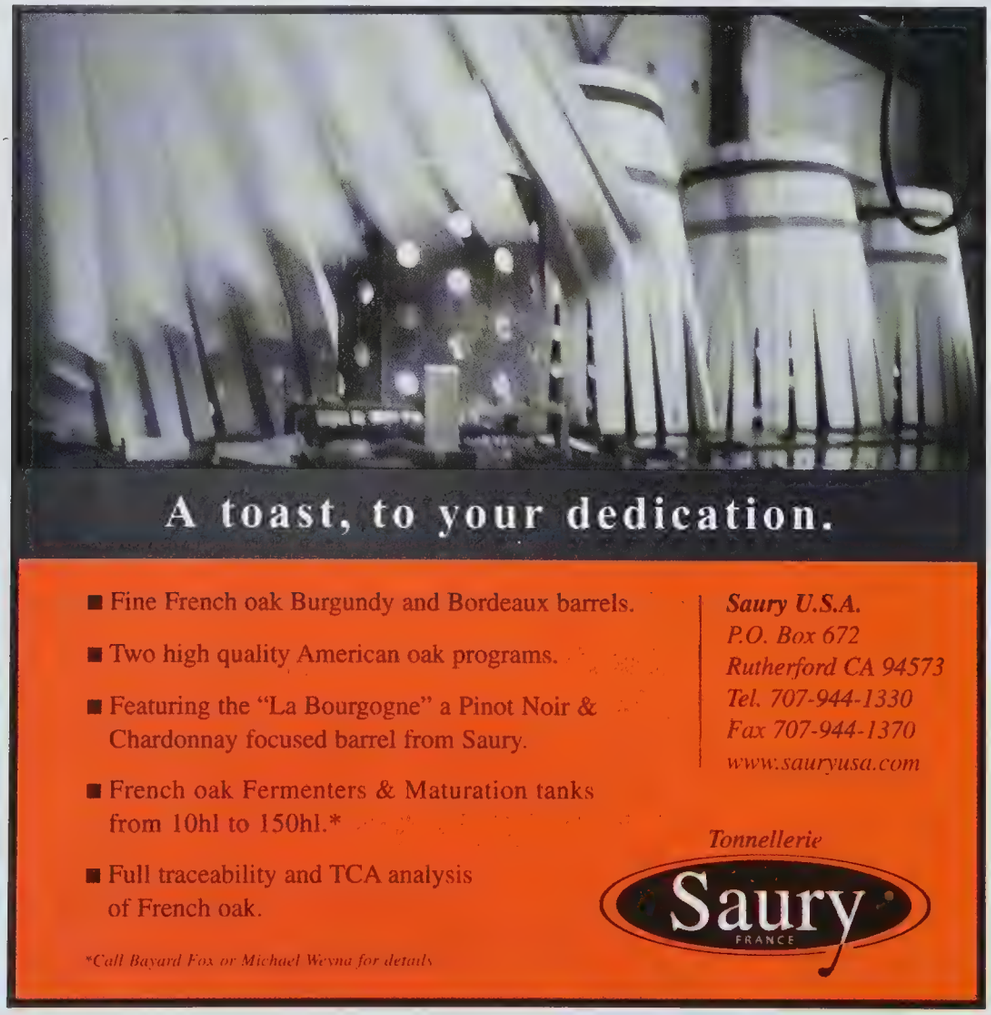
The white barrel cellar has linear lighting along the wall, and work lights down the center of the room. An urethane modified concrete coating was applied in this room.

Grape storage room has capacity for 20 tons of grapes. Two cooling units can chill grapes and/or reduce moisture from wet grapes. Cooling is provided by the same chiller as the office air conditioning. If demand for chilling increases, then office air conditioning turns off.

Heating and cooling — The barrel ageing cellars are placed below grade to take advantage of the natural cooling capacity of the earth, and to minimize dependency on mechanical cooling systems. The cellars are cooled with nighttime air pulled through the cellars by fans at the lowest part of the winery. On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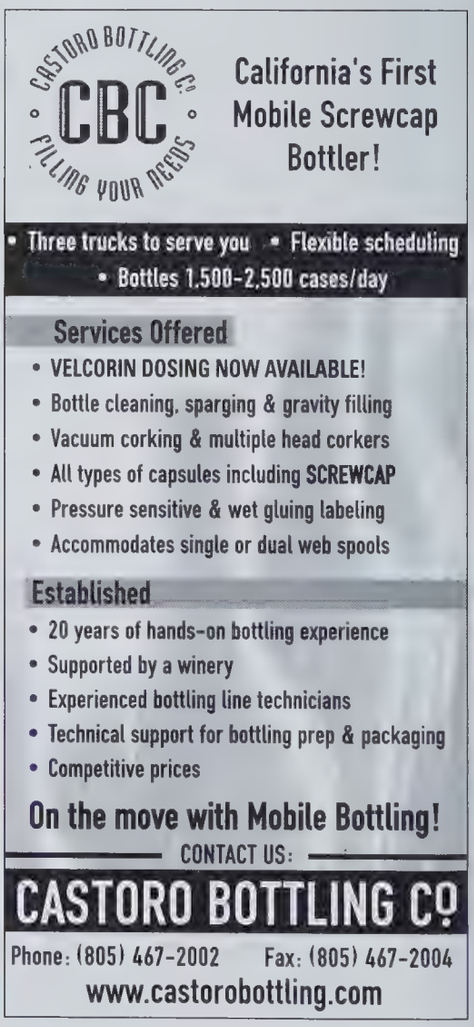
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this site, air is available at 55°F or lower for a few hours each night, even during the hottest summer months.

Nighttime air is supplied to the cellars through an insulated thermal mass of rock contained between the fermentation floor and the ageing cellar ceiling. This thermal mass tempers air before it enters the cellars. During the night, heat is taken away by the cool air. During the day, the thermal mass is used as a heat-sink to cool the air before it enters the cellars. This is particularly important during harvest, when it is necessary to exhaust CO_2 generated by the round-the-clock fermentation process.

Very cold air can also be warmed by the thermal mass before it enters the ageing cellars. Sensors measuring and comparing the temperature of the cellars and outside air control the amount of air entering the cellars. The mass of the concrete and stored wine in the cellars also help to stabilize temperatures.

During the design, another step was taken to conserve energy, reduce heating and cooling system size and initial cost. The air conditioning system in the offices is designed to automatically turn off if the process (tank) cooling system requires cooling beyond the capacity of the system.

Windows — Stoller Winery uses thermally broken aluminum windows and low-emissivity (low-E) insulated glazing throughout the building for increased energy efficiency. A thermally broken window uses a material of low thermal conductivity inserted between the inside frame and the outside frame in order to reduce heat transfer between the two. Low-E glazing has a thin coating of metal oxide that reduces heat loss, while admitting visible light. The building's orientation and shading devices also reduce summer heat-gain.

Daylight, views, and thermal comfort all help to create a productive and healthy work environment. Building occupants in all regularly occupied office spaces are provided with a connection to the outdoors. Skylights and well-placed windows offer natural lighting that reduces the use of electric lighting.

Another important goal was to conserve water usage, and to ensure that any by-products from the winemaking process were used to the fullest extent possible in order to minimize impact on landfills and the surrounding environment.

Harvesting rainwater — Runoff from the winery roof and site is collected and filtered through native vegetation, then contained in a pond, which also acts as a required reservoir for fire fighting and a wetland habitat for local wildlife. Plantings of native and adaptive plants created a landscape around the winery that no longer requires irrigation after a two-year establishment period.

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Process waste —A separate plumbing system is used to collect water that is used to wash down the winery during the winemaking process. After the solids have been settled out, this water is then reused to irrigate a pasture west of the winery. In addition, employing a power washer during cleanup results in less water being used. The process solids (grape skins, stems, and seeds) are given to a nearby organic dairy that composts the material for fertilizer for their pastures.

Sanitary Waste — Low-flow plumbing fixtures have been employed to maximize water efficiency and decrease the load on the traditional septic system.

The choice of building materials is a key component of LEED certification. The use of recycled materials, or materials with a high percentage of recycled components, is encouraged. In addition, materials that are healthy, sustainably grown, and require less energy to manufacture are favored. Wherever possible, products were purchased locally in order to minimize the amount of energy needed to transport them to the site.

Concrete and metals — The concrete mix that was specified contained a high percentage of fly ash instead of cement. Fly ash is a byproduct of coal-burning in electric generation and steel production. Most manufactured steel and aluminum has a high percentage of recycled materials.

Much of the building is made from concrete, either embedded below the surface or clad in insulation, and a corrugated galvanized steel siding, and is detailed to mimic existing agrarian structures remaining from the farm's turkey days. With these materials, it is expected that the structure will have a life expectancy approaching several hundred years.

Wood — The large structural columns and beams used in the construction of the harvest porch, and stair treads for the main stairs, came from beams that were salvaged from the 1999 demolition of Powell's Bookstore in downtown Portland. Stoller had purchased the 19-foot x 27-foot x 50-foot -long beams and stored them in a turkey shed in anticipation of the winery construction.

Finishes — Interior materials, such as carpet, paint, adhesives, and sealants were chosen based on their volatile organic compound (VOC) content. Low-emitting materials were used to reduce the quantity of indoor contaminates.

Recycling — Efforts to reduce waste and recycle materials figured into the selection of materials for the building, recycling of construction waste, and daily winery operations. Recycled materials were components of most materials used in the winery. This ranged from the concrete, steel, and wood framing, to the carpet, laminate, and paint used for finishes.

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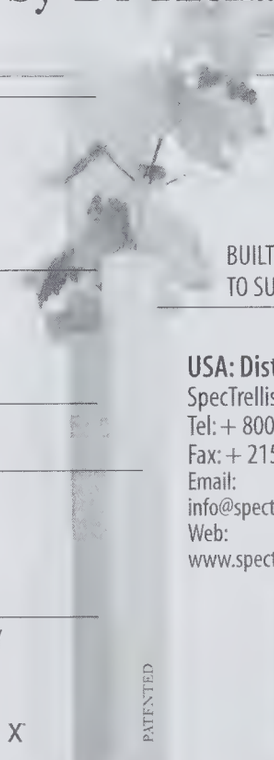

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Over 95% of construction debris was diverted from landfill and directed back to the manufacturing process or to other construction projects for use.

Recycling collection bins are placed throughout the winery to promote the winery goal to reduce packaging waste. Each recycling storage area has separate bins for the collection and storage of paper, corrugated cardboard, glass, plastics, and metals.

Wire racks, instead of cardboard, are used to store an ultimate capacity of 7,800 bottles in a wine library.

As a future consideration, the winery was planned so that an expansion beyond its 7,500 case production to13,000 case capacity could be accomplished with a minimum of disruption, waste, and environmental impact.

Construction process

The construction process was also an important part of LEED-certification. The content and origin of the major building supplies were documented for submission to the Green Building Council. Ninety-six percent of construction waste was recycled, redirecting recovered resources back to the manufacturing process and reusable materials to appropriate sites.

LEED is not a design/construction path to be recommended for everyone, inasmuch as the initial investment in goods and services is somewhat higher than using more conventional methods.

We now anticipate the LEED track adds an additional 1% to 4% to the initial cost of a project, with about 25% of that cost for design. In our experience, LEED certification is difficult to justify on small projects, where the percentage may be higher.

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will be recouped during the course of operations.

Building costs

At Stoller Vineyards, the energy and water savings designed into the building will save money and resources over time. There are also federal and Oregon state tax credits available for energy-efficiency measures. In addition, the Energy Trust of Oregon assisted in the construction of the solar array with a substantial grant. As the cost of fossil fuel energy goes up, solar is a very wise choice, especially in this sort of application.

When it comes to preserving the natural beauty of a location, such as where this winery is situated, the value of sustainable design can't be measured in mere dollars and cents. It made all the more sense for the Stollers, who were planning and building to sustain the future generations of their family.

The inflation of building costs during planning and construction were much more difficult to deal with. The demand for building materials, due to explosive growth in mainland China and several hurricanes in the Gulf Coast region, drove up building costs by about 15% to 23% over the course of the project. These costs were not anticipated, and added no value to the project. While recent inflation rates are not nearly as steep as when the Stoller winery was constructed, we still plan on rates of 7% to 8% per year in the Portland regional area.

More than a decade after initial consultation with Bill Stoller, and a little more than two years after breaking ground, construction was completed, LEED-certification was obtained, and the winery opened for visitors on Earth Day, April 22, 2006. ■

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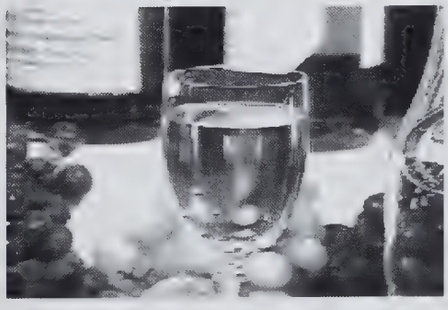

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Napa Valley

Is the tier system a bad idea?

BY Kurt Krause,
Addendum Marketing

Many small wine producers have been grumbling about the three-tier system and point out disadvantages to small and mid-size wineries. You are required to work within these laws, like it or not. Why not step back, and think about how you can use the three-tier system to your advantage.

The 21st Amendment ended Prohibition and returned to the states extensive power over the sale and distribution of alcoholic beverages. Its passage also allowed federal and state authorities to impose taxes on wine, spirits, and beer, which generate billions of tax dollars annually for local, state, and federal authorities. This is a benefit these governments will not willingly give up.

However the 21st Amendment also prompted U.S. federal authorities to issue regulations outlawing the pre-1919 existence of the "tied-house," a legal system under which a brewery, winery, or distillery typically owned or controlled one or more retail establishments, excluding in the process all other competition. Through the Federal Alcohol Act of 1933, this so-called tied-house, and other anti-competitive arrangements, are forbidden within the nation's three-tier distribution system. The system provides for the explicit separation of ownership of producer, distributor, and retailer, with very few exceptions.

Three-tier system does have advantages

The big advantage of the three-tier system is that it provides a level playing field for small and mid-size wineries against the "Big Guys."

How so? Don't the large wholesalers cater to the large wineries and their high-volume brands? True enough... But although large producers might get more attention, they can not eliminate a small producer! They cannot buy your space in the retailer, and they cannot control any retailer's inventory.

Thanks to the same 21st Amendment and the Alcohol Act of 1933 that gave birth to the three-tier system, slotting fees, and exclusivity contracts typical of chains are totally illegal in the sale of alcoholic beverages. This is a big protection for small and mid-size producers and their brands. The smallest producer is protected from the financial prowess of the proverbial large producer who could virtually keep him out of the marketplace if the 21st Amendment and the Alcohol Acts it perpetuated did not exist.

For example, if you were a producer of non-alcoholic beverages, the big brands could "buy" you right off the shelf, digging into their deep pockets and literally purchasing your shelf space — or worse, they could make sure you never get on the shelf or into that restaurant in the first place. This is done through a number of disturbing but legal "big-guy-tools" called slotting fees for off-premise retailers and exclusivity-contracts for restaurants.

Whatever you might spend on providing marketing support materials, such as brochures or tasting notes, is not only minimal compared to the hundreds of thousands of dollars spent by non-alcoholic beverage producers to purchase space on chain store shelves, it is also proportionate to the number of cases you have available to sell to that distributor.

A lot of states restrict what marketing-help a producer can provide to a retailer: nothing is allowed that is perceived as inducing a retailer's customers to purchase and consume alcohol. These restrictions, which apply, by law, to every producer both large and small, are "inducements" passed on to the consumer such as gifts and premiums, sometimes free tastings or even discounts and coupons, and particularly sweepstakes.

Compare the laws that protect the alcohol industry with the lack of laws for producers of non-alcoholic beverages. Say you had a really good cola brand. What would it take to get a chain to carry your product over the large national brand, or even alongside it? For that matter how many cola brands do you know that even exist today?

Is it really easier to operate without these controls?

Colas and soft drinks are not required to operate within a three-tier system and have evolved into an industry that is virtually controlled by two big brands.

What happened to the hundreds of local cola brands that had existed throughout the U.S.? Now ask that same question about wine brands and apply the analogy to the thousands of small and mid-size wineries that today exist in all 50 states.

For example, let's review the "Havana Cola" brand. America Vaughan (a spirited Cuban immigrant) started producing this cola in her kitchen in Winter Park, Florida in 1993. Bottling and distributing the brand, Vaughan says, "I decided to follow the example of Gloria Estefan, who grew to fame by

marketing herself outside the Cuban community."

Although this strategy worked for Havana Cola, the problem was always butting heads with bigger brands. "I learned the hard lesson not to advertise on my website the accounts that carried my cola," America complains, "because Coke would pay attention and, by providing expensive coolers and lucrative contracts to my hard-won accounts, could directly push me out."

Sandy Nixon, president of Havana Beverages (Louisville, KY) and a veteran of the soft drink industry, fell in love with the brand and now bottles and distributes Havana Cola under a license agreement. Nixon positioned the brand as a super-premium cola so as not to have to compete with Coke and Pepsi on a head-to-head basis. He distributes 20% direct to retailers and 80% through specialty food distributors.

Nixon has achieved distribution in upscale stores and specialty food sections in mainstream stores, but he feels the power of the exclusive contracts of Coke and Pepsi in on-premise accounts.

An example is Churchill Downs in Louisville, which wants Havana Cola, but the venue is an exclusive Pepsi "pour." Nixon laments the fact that Sam Adams can exist and thrive in an account next to Budweiser or Miller but Havana Cola is effectively kept out of the endless "exclusive pour" accounts.

"Louisville used to have five small local soda bottlers — all gone now but for us," says Nixon. "But there are a number of micro-breweries that continue to thrive, one right next door to me!"

The Kentucky Wine website (www.kentuckywine.org) lists more than 30 wineries in the state.

"Some days I wish I could put rum in Havana Cola and then I'd have the right to get into any account," he says, only half in jest.

Use the middle tier to your advantage

In my experience, there are three categories of wine consumers. There is the category that only shops in supermarkets and buys wine based on price, and especially a reduced sale price. There is a small group sometimes called "elitists" or "wine snobs" that routinely purchase wines based on score and brag about them. But these overlap into the much larger and growing group of emerging mid-market consumers.

Mid-market wine consumers like to "discover" more obscure wines. They will explore bottlings from small boutique wineries and new imports, and they perceive the point system as primarily inflating the cost of a wine. They have had wines recommended by a sommelier or wine store manager

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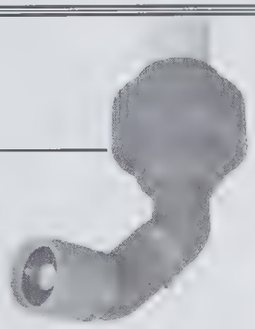

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that have turned out to be not as expected or often simply not to personal taste. Retailers know this, and a good distributor will be able to sell to a retailer all wine categories.

Whether or not your wine carries a rating, all good wine salespersons sell brands they feel comfortable with, because either they have been given above-average information about the brands or they have a good personal relationship with the wineries' representatives, management, or owners.

Whether your brand is with a large wholesaler or a small one you can establish share-of-mind for your wine brand. Focus and clearly define your sales efforts through direct contact with a select few of the wholesaler's salespersons.

Get involved with your wholesalers. Do not assume the distributors are your end-customers, do not ship and then disappear on them. Pick their brains and use their strengths so that your wine sells through for them, to retailers, and ultimately to consumers.

Distributors can perform many sales and marketing functions, all of which you would have to do yourself if you were selling direct to retailers or consumers.

For retailers and restaurants, wholesalers provide rapid and frequent deliveries, often splitting cases to accommodate small orders and, above all, those elusive re-orders. Their ability to fill small orders for low-volume wine brands have allowed consumers to choose among hundreds of brands that might otherwise have been pushed from, or have never even reached, the marketplace.

By holding tasting seminars, developing and printing wine lists, training bartenders and wait staff, and suggesting food/wine pairings... wholesale distributors let you be in many places at one time. Get involved with them so that they can make sure your product is being sold while you are busy making good wine, the job you love best. ■

[Kurt Krause has dedicated his career to introduction and integration of brands through the national beverage distributor network. Entrepreneurially-driven, Krause has a well-developed sense to spot niche opportunities and a keen intuition to make them work. He does consulting on marketing within the three-tier distribution system.]

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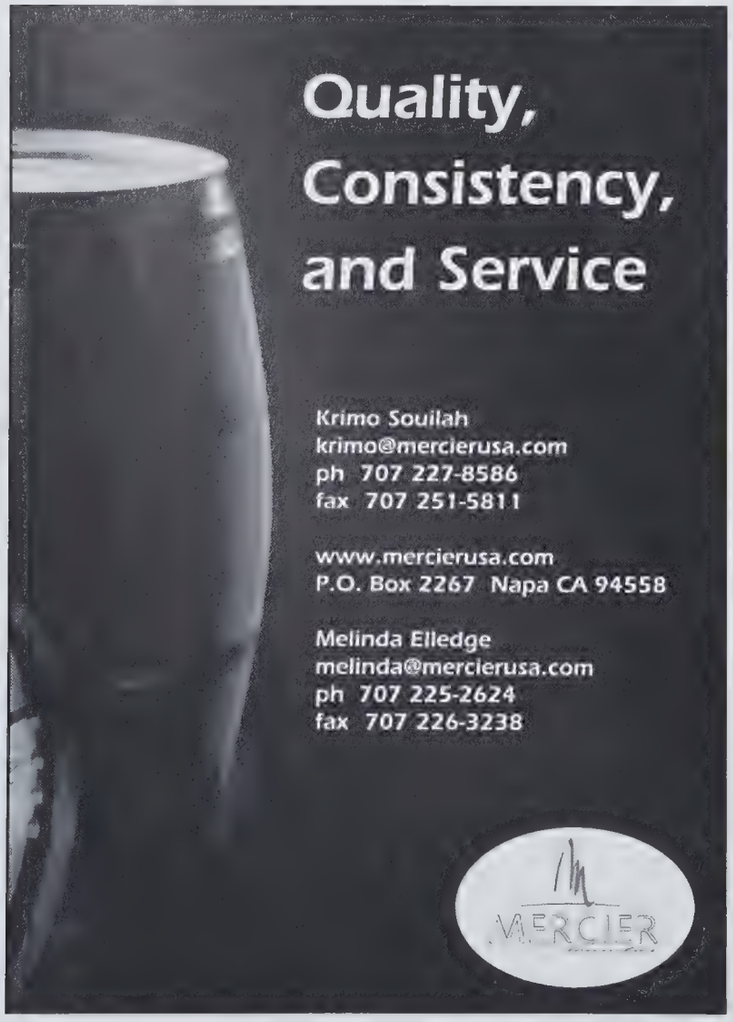

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Researcher Alan Tenscher applies a droplet of PD bacteria suspension to a test vine-stem.

INTERVIEW WITH DR. ANDY WALKER, UC DAVIS

Development of grapevines resistant to Pierce's disease

Alan Tenscher demonstrates results of accelerated growth process, holding vines forced from seeds, flowering precociously after only five months.

Once young vines are inoculated with PD bacteria, they are watched for symptoms of PD, and tested for the presence of resistance markers. About 50% will be PD-resistant, and used to breed PD-resistant vines.

BY Ken Freeze

HOW LONG HAVE YOU BEEN WORKING ON PD-RESISTANT WINEGRAPE VINES?

Using traditional methods, I have been breeding PD-resistant grapes since 1997 — first on a small scale, then on a larger scale in 2004 as funding increased for PD-resistant winegrape breeding. The California Department of Food & Agriculture Pierce's disease/Glassy-winged Sharpshooter (PD/GWSS) Board asked us to switch our primary emphasis from table and raisin grapes (a collaborative project with David Ramming, U.S. Department of Agriculture-Parlier, CA) to winegrapes.

In 2006, we also received funding to continue our table grape breeding collaboration with David Ramming through the University of California PD/GWSS Board. Our progress on winegrapes has been remarkable given the relatively few years we have been at it.

The strong progress has been the result of advances made by my other Pierce's disease (PD) project on the genetics of resistance and our ability to find DNA markers that are closely linked with PD resistance, so that we can use these markers to screen many of our progeny. This allows us to plant and grow-out twice as many seedlings, and only plant resistant ones in the field for fruit evaluation.

HOW DO YOU DO CREATE NEW PD-RESISTANT GRAPEVINES?

Our genetics of resistance project discovered a source of PD-resistance in an accession of *Vitis arizonica* that is controlled by a single dominant gene. When you cross to it with any *vinifera* variety, half of the progeny are resistant. Other forms of PD-resistance from other *Vitis* species are much more complex and crosses between those and *vinifera* can result in very few resistant progeny.

Breeding progress is all about the number of seedlings you can evaluate, since fruit and wine characters combine in unpredictable ways. So, the more progeny, the better the chance of producing PD-resistant and high-quality offspring.

A resistant plant from a first-generation cross with the single, dominant gene form of resistance can also be crossed back to *vinifera* repeatedly and still yield 50% resistant progeny in each generation. The first generation is 50% high-quality *vinifera* genes, the next (75%), the third (87%), and the fourth (94%). We made wine in September 2007 from vines that are 87% high-quality *vinifera* and PD-resistant, and have sprouted seedlings that are 94% *vinifera*.

The crosses are relatively simple. We choose a female *vinifera* wine par-

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ent and use a paper bag to prevent unwanted pollen from contaminating it. We then take a selected male parent (a cross from a PD-resistant selection at an advanced generation) and dust its pollen on the female parent cluster. Six months later, we extract the seeds, treat and chill them, and sow them out to produce the next generation.

WHAT TRADITIONAL WINEGRAPE VARIETIES ARE YOU WORKING WITH?

In 2006, we made crosses with Alicante Bouschet, Cabernet Sauvignon, Carignane, Chardonnay, Chenin Blanc, Colombard, Sauvignon Blanc, Symphony, Syrah, Tannat, and Tempranillo. In 2005, we crossed to Airen, Alicante Bouschet, Barbera, Cabernet Sauvignon, Chardonnay, Cabernet Franc, Syrah, Viognier, and Zinfandel.

WHY THOSE GRAPE VARIETIES?

We are trying to maintain as wide a range of diversity from high-quality *vinifera* to enable the selection of a broad range of fruit and wine styles.

ARE CERTAIN *VINIFERA* WINEGRAPE VARIETIES MORE RESISTANT TO PD THAN OTHERS?

Not really more resistant, but less susceptible … they all die within three to six years (which is somewhat dependent upon climate).

HOW DO YOU DETERMINE IF A GRAPEVINE IS RESISTANT TO PD?

We inoculate the plants with PD bacteria and wait four months. Then we evaluate the amount of bacteria in the stems eight to 12 inches away from the inoculation point. We quantify the bacterial numbers with ELISA (an efficient and inexpensive immunoassay) to allow testing of huge numbers of plants. We also score symptoms and compare the resistant plants to controls or standards like Chardonnay.

WHAT IS MEANT BY "RESISTANT"? DOES THAT MEAN A VINE CAN STILL GET PD BUT IS LESS LIKELY TO? OR THAT THE VINE WILL NOT GET PD EVER?

No species is fully resistant to PD. All species seem to allow the bacteria to reproduce to some extent. Resistant species greatly limit reproduction and movement, while susceptible species do not restrict the bacteria. The forms of resistance we use greatly restrict the movement and reproduction of the bacteria and do not allow disease symptoms to form.

HOW BIG A ROLE HAS GENETICS PLAYED IN AIDING YOUR RESEARCH?

Our companion genetics project is mapping PD-resistant genes. This process allows us to locate these genes on chromosomes, and we have initiated efforts to physically locate those genes so that we can better understand how they work and allow efforts to genetically-engineer grapes with grape-resistance genes. In the process of locating the genes, we have discovered genetic markers that are very tightly linked to PD resistance, and we can use the markers to prescreen for resistance as soon as the seeds germinate.

YOU HAVE DEVELOPED A METHOD TO SHORTEN THE TIME NEEDED FOR THE BREEDING PROCESS. HOW DID YOU DO THAT AND HOW MUCH TIME HAS BEEN SAVED?

We use the genetic markers described above to screen seeds as soon as they sprout and have been able to force seedlings to bloom in their second year by aggressively growing and training them. The biggest advantage is having the markers for our unique, single, dominant gene PD-resistance source, since 50% of the progeny are resistant and we can backcross to *vinifera* and generate large numbers of resistant progeny.

This huge advantage was a result of the discovery of this single "gene" resistance from *Vitis arizonica*. We are now exploring other forms of this species to determine how prevalent this form of PD resistance is and whether other forms might be even more useful.

The standard breeding cycle from seed-to-seed is five to six years. We have reduced that to three years and have generated far more resistant progeny, which allows us to select for the best combination of resistance, and fruit and wine quality in the shortest time frame.

CAN YOU ESTIMATE THE RESEARCH-COST TO REACH THIS POINT?

It is difficult to calculate. The program began on a limited scale in 1998 as part of an American Vineyard Foundation long-range collaborative project. I received about $70,000 to $85,000 per year then. By 2001, we were breeding PD-resistant table grapes in a collaborative project with David Ramming and were each receiving about $80,000 per year. The genetics program was funded with about $100,000 per year in those days.

By 2004, we redirected to winegrape breeding and received about $150,000 for genetics and $150,000 for breeding each year. I guess it depends on which project and when … but it is all intertwined.

HOW FAR ALONG ARE YOU TO HAVING A WINEGRAPE VINE THAT GROWERS CAN USE?

We made and evaluated wines from 87% PD-resistant *vinifera* selections in 2007 and they competed very well with other *vinifera* wines made at a small six-vine scale. Some of these selections might be usable as a blending variety planted in PD hot spots. We will have 94% PD-resistant selections for fruit evaluation in 2009, with wine evaluation the year after that. Selections within this percentage *vinifera* should be very high-quality winegrapes.

At the same time. we have been breeding powdery mildew-resistant winegrapes so that we can combine PD and mildew resistance with excellent wine quality and further broaden the appeal and use of these resistant grapes. ■

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Anagyrus pseudococci, parasitoids of VMB, are distributed (one to five per vine) at Spring Mountain Vineyard. Sterling Insectary will produce more of the parasites in 2008 for other research vineyard plots.

INSET: Close-up of new strains of anagyrus pseudococci imported from Italy by UC Berkeley.

SPRING MOUNTAIN VINEYARD

UC Berkeley introduces beneficial insects to control vine mealybugs

BY Jack Heeger

When Ron Rosenbrand joined Spring Mountain Vineyard (St. Helena, CA) in 2003 as vineyard manager, he found a two-acre block of about 400 vines that had become infested with vine mealybugs. Two years later the infestation had spread to 10 acres, and 10% of the crop was not harvested.

It wasn't just smatterings of honeydew he saw on clusters — it was large clumps.

When the original infestation was discovered, there was little knowledge and field experience in coastal regions with managing control of or eradication of vine mealybug (VMB). Instead, the intent of a county-wide compliance agreement from the Napa County Agricultural Commissioner's office was to keep VMB populations from spreading by trying to eradicate VMB with insecticide sprays.

Rosenbrand embarked on a spraying program to try to control VMB. The insecticides suppressed VMB damage, but after three years of spraying insecticides, eradication had not been achieved and the infestation still continued to spread.

"We wanted to do something more environmentally friendly," Rosenbrand says. "Our neighbors were upset," and so was he, "especially when there was a trend toward organic and environmentally correct farming."

He approached Napa County Ag Commissioner Dave Whitmer and asked for permission to try an alternative that had not yet been approved — using insects to manage vine mealybug. Whitmer replied that he would give temporary approval if Rosenbrand could recruit UC Berkeley scientists Kent Daane (UC Berkeley Cooperative Extension specialist) and Dr. Monica Cooper (staff research associate, with a Doctor of Plant Medicine degree from the University of Florida) to work with him.

Insect control tested at many sites

Since 2006, Spring Mountain Vineyard has been one of many sites throughout the state where the UC Berkeley team have been researching the use of insects as sustainable tools to manage VMB populations. These tools include the release of beneficial insects (biological control), mating disruption using pheromone dispensers (manufactured by Suterra Inc, Bend, OR), and the judicious application of more target-specific

The program at Spring Mountain aims to eliminate this type of damage to a grape cluster by vine mealybugs.

insecticides (such as insect growth regulators, neo-nicotenoids, and "lipid biosynthesis" inhibitors.

"I figured if the insects didn't work, we could always fall back to the insecticide program," Rosenbrand explains.

The insect-release program began in 2006. "We released everything that would eat a mealybug," he recalls. They released predators, which consume all VMB stages from egg to adults, and parasitoids, which lay eggs inside the VMB and eat it from the inside out.

"The two strategies are complementary, not contradictory," Rosenbrand says. "The difference is that some of the predators tend to work best in high-density populations, while parasitoids can work well at both high and low density populations, and they are not as likely to disperse."

Although the insecticide sprays (Lorsban, Lannate, Dimethoate, Provado, and Applaud) were not successful in eradicating the mealybugs, they did serve a useful purpose. First, they kept the VMB population below damaging levels. Second, although they weren't the target at the time, Argentine ants, were also victims of some of the insecticides.

"The sprays killed everything except the mealybugs beneath the bark. But it did kill the ants," Rosenbrand recalls. "That meant we could start with a clean slate."

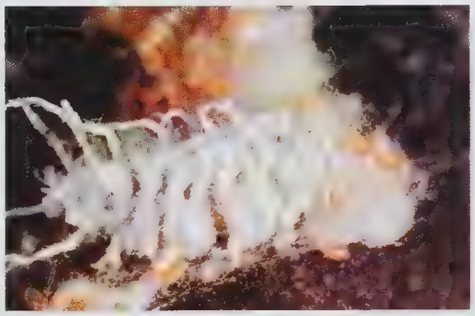
"The Argentine ants may directly kill some beneficials," explains Cooper, "but mainly the ants protect the mealybugs by disrupting the behavior of the beneficials (parasites are unable to lay eggs and predators are unable to consume their prey).

The UC Berkeley team began releasing insects one month after bud break in 2006 — 18,000 *Coccidoxenoides perminutus* (a small, black parasitic wasp), on April 19. One day later 30,000 ladybugs were released, 50,000 green lacewings, and 2,000 minute pirate bugs. On April 25, 5,000 *Cryptolaemus montrouzieri* (beetles appropriately named the "mealybug destroyer") were released, and one week later, 80,000 more ladybugs. On May 17, the parasite *Anagyrus pseudococci* (a brown parasitic wasp with white-tipped antennae) was released, with 50 females and 25 males.

"In the beginning, my strategy was eradication," recalls Rosenbrand. "We released everything we could obtain. Now things have changed somewhat to a more refined approach using insects that have proved their success."

During the months that followed, various quantities of those insects were released. All predators were purchased by Rosenbrand through a commercial

Closeup of vine mealybug female.



A large Cryptolaemus larva (the mealybug destroyer) feeding on a mealybug "ovisac."

A large larva of the mealybug destroyer (Cryptolaemus) next to a small mealybug.

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insectary. The parasitoids were part of a joint UC and California Department of Food and Agriculture bio-control program.

"The *C. perminutus* were imported from South Africa and the *A. pseudococci* were brought in from northern Italy, both were collected on VMB and may perform better than the native parasites," Daane explains.

By the end of the season, Rosenbrand and the UC Berkeley team had released 1,765 *Anagyrus*, 94,650 *Coccidoxenoides*, 35,000 *Cryptolaemus*, 670,000 ladybugs, 10,000 minute pirate bugs, and 700 cards each containing 500 green lacewing eggs for a total of 350,000 lacewings.

The scientists sampled mealybug populations between April and October, and monitored parasitism rates and economic damage to grape clusters before harvest. From these mealybug samples, both *A. pseudococci* and *C. perminutus* were recovered, thus confirming their ability to reproduce under field conditions.

Pheromone cards play big role

In addition, 2,500 pheromone card-dispensers were placed in June; they lasted through the season. "Pheromone cards are a big part of the program," Rosenbrand explains. "The cards contain the synthetic version of the sexual attractant of the female VMB that attracts the male."

"Each card slowly releases the equivalent scent of 10,000 female mealybugs," Cooper adds.

According to Daane, the actual mechanics behind the "mating disruption" are not yet understood because the unmated female can still produce eggs. The researchers believe that application of the synthetic sex pheromone may reduce the number of female eggs produced, and it might help stimulate the parasites to look for VMB in the vineyard.

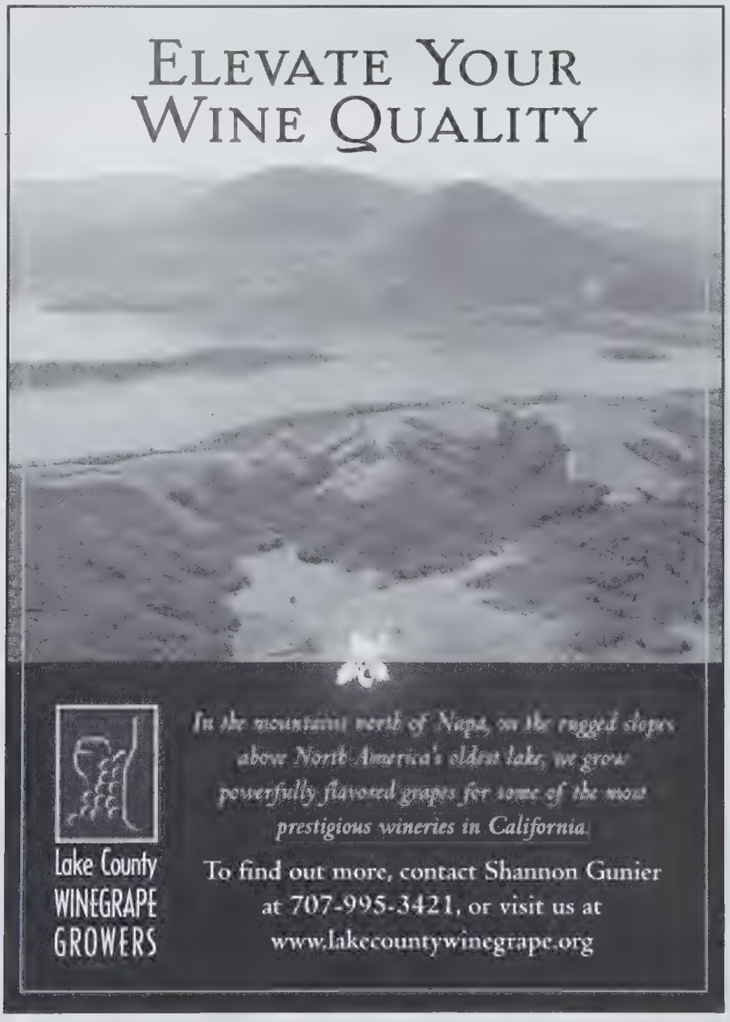
"I feel there is a favorable impact from the cards," Cooper reports, "although, to date, we have not been able to isolate that impact in our experimental trials." The downside to pheromone cards is that they can disrupt the work of vine mealybug scent detection dogs, making it harder for them to find their live target."

Currently, the pheromone cards are not on the market and have been tested under a U.S. Department of Agriculture experimental-use permit. The UC Berkeley team has applied for a "Section 18" — or an emergency use exemption, and Suterra is pursuing standard registration.

Spring Mountain Vineyard isn't the only place where sustainable tools are being tested, explains Cooper.

"There are 250 acres of vines (statewide) where the pheromone cards are being tested."

Complementing the insect releases at Spring Mountain Vineyard, Rosen-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brand applied Applaud, a soft chemical that only kills insects in early development stages. "It does not harm adult insects," notes Rosenbrand. Champ, Flint, Thiolux, and sulfur dust were applied to control powdery mildew, at low rates to minimize injury to beneficial insects.

A similar insect-release protocol was repeated in 2007, starting just two weeks after bud break, but without minute pirate bugs. "They are so small that we couldn't track them," he says. "We also stopped distributing green lacewing egg cards in mid-2007, because we saw that not all the eggs were hatching, nor did we have any evidence that the lacewing population was increasing or even established in the infested vineyard."

Overall in 2007, 6,055 *Anagyrus pseudococci*, 9,450 *Coccidoxenoides perminutus*, 35,000 *Cryptolaemus*, and 240,000 ladybugs were released by the UC Berkeley team, and 250,000 green lacewing eggs before he stopped using them. Once again, both parasites were recovered from mealybug samples taken throughout the season, and there was a season-long decline in mealybug populations. *Cryptolaemus* larvae were also observed during monthly sampling activities.

Measuring effectiveness

"All were effective, to some degree," says Rosenbrand. "We are the least confident about the ladybugs, but there's good evidence that *Anagyrus pseudococci*, *Coccidoxenoides perminutus*, and *Cryptolaemus* are effective.

The number of *Anagyrus* released in 2007 was tripled because they were the most effective at parasitizing the mealybug, and greater quantities were available because UC Berkeley partnered with Sterling Insectary to produce the insects. We saw many *Cryptolaemus* larvae that overwintered between 2006 and 2007 feeding on all stages of VMB in Spring 2007."

On each release date, the parasites were distributed every five to ten vines, to evenly cover the entire block. "We released what we had from a limited supply," he adds. "We obtained them from UC Berkeley, and worked with Sterling Insectary (in Kern County) to develop more, but we still cannot obtain as many as we need to cover all of the hot spots."

"The number of *Anagyrus* released in the experimental block was appropriate and sufficient," notes Cooper. "When Rosenbrand states that he wants more, this would be for other areas of the vineyard, not for the experimental area.

"Fewer *Coccidoxenoides* were released in 2007 — only 10% of what was released in 2006. We don't know how effective those were." It is more difficult to measure the impact of *C. perminutus* because their preferred host stage is a small nymph — which can be difficult to collect — and they may fall to the ground when they pupate, making them challenging to locate."

Success of insect-release program

How successful was the overall program? "There was no honeydew on the clusters during the 2007 harvest," reports Rosenbrand. "We saw no need to go through and remove clusters. We harvested everything."

In 2007, the researchers conducted a cluster sampling before harvest and found 95% of clusters free of mealybug damage; and 5% of the clusters sustained minimal damage (an average of less than 10 mealybugs per damaged cluster). This was even lower than in 2006, when 81% of the inspected clusters were free of damage, 18% sustained minimal damage (as described above) and 1% sustained major damage. There were no clusters in either year that researchers rated as "unharvestable" on their rating scale.

Jac Cole, Spring Mountain Vineyard winemaker, recalls that when he joined the winery in 2003 the vines were already infested, so he has had no experience with unaffected fruit from that vineyard. But the 2007 vintage produced the best fruit he had seen in five vintages. "I don't know if it was coincidence, because I have no data to look at about fruit prior to the infestation. But there was no honeydew problem in 2007."

Rosenbrand and Cooper note that the program is still in the experimental stage. "We're still testing the concept and doing research," says Cooper.

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VMB overwinters under the bark, and as the season progresses the population moves onto the leaves and canes, and eventually into the ripening fruit.

"Especially as we fine-tune release rates, timing, the ability of these beneficials to establish populations in vineyards, and the optimal combinations of insects to release."

Rosenbrand adds, "If this were 100% proven, Cooper would not be working with us as a research scientist to learn and explore the effectiveness of using bio-control to control VMB."

Other research plots in California

In addition to working with Spring Mountain Vineyard, in 2006 and 2007, the UC Berkeley team had about 12 other research plots located in Napa County, Sonoma Valley, the Central Coast region, the Lodi area, and raisin vineyards in the San Joaquin Valley (these were directed by Glenn Yokota, Cooper's counterpart at the Kearney Agricultural Center).

Cooper reports similar results from around the state. "Crop damage was minimal in all plots and both parasites were recovered in monthly mealybug samples."

Daane notes that a key is to first suppress the mealybug densities with properly applied insecticides. The sustainable tools will not rapidly reduce large, damaging mealybug populations, but they have proven capable of maintaining low density populations below damaging levels.

In 2008, Cooper will supervise eight plots in the North Coast, eight in the Central Coast, and eight in Lodi, but those in Lodi will not use predators, only parasites. Yokota will supervise six plots in the San Joaquin Valley. The researchers plan to monitor each plot at least once monthly.

The UC Berkeley team is also investigating which natural enemies might work best together. Cooper explains that, in a Carneros vineyard, they have isolated individual vines in large, walk-in cages and added different combinations of beneficial insects (*A. pseudococci*, *C. perminutus*, and *C. montrouzieri*). The researchers hope to determine how the species interact to control VMB populations.

Any vineyard manager who has a large mealybug infestation should first knock it back with an insecticide,

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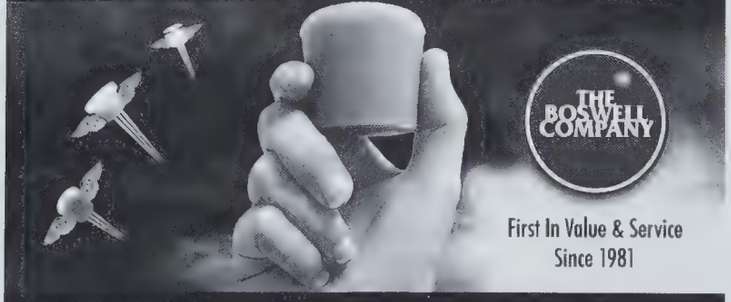
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Pheromone cards for the mating disruption program at Spring Mountain Vineyard contain scent = 10,000 female VMB, released in a six-month period.

notes Cooper. "The next step is to then deploy bait to target Argentine ants." As mentioned above, Argentine ants disrupt the activity of beneficial insects, so ant populations must be controlled before biological control can be successful. If someone tries to release insects to control the VMB, they won't do the job well if there are large Argentine ant populations which disrupt the beneficial insects.

"When we were working under the Napa County compliance agreement," Rosenbrand recalls," before we began the bio-control program, we sprayed many times per year with Dimethoate, Lannate, Applaud, Provado, and Lorsban. The attempt with all this was VMB eradication!

"In 2006, we sprayed twice with Applaud, and once in 2007. Applaud is a soft chemical which is a growth regulator and it does not allow nymphs to become adults. The Applaud applications were not intended for ant control (and probably have little impact on the ants)."

Stripping the bark from vines to help to expose mealybugs is recommended by Rosenbrand. "We stripped bark manually in 2003, but have not stripped since. Bark-stripping by hand is incredibly expensive. There is a new tool to air-blast the bark, which should help decrease the cost of manual bark-stripping.

"Someone who has a mealybug problem can get a head start by controlling ants with the use of ant bait stations, and reducing VMB populations through bark-stripping, and spraying insecticides, to prepare the way for beneficial insects."

All of these techniques are essential to bring VMB populations from high densities down to low to moderate densities. At these lower densities, the sustainable management tools described here can then be employed to manage VMB populations. ■

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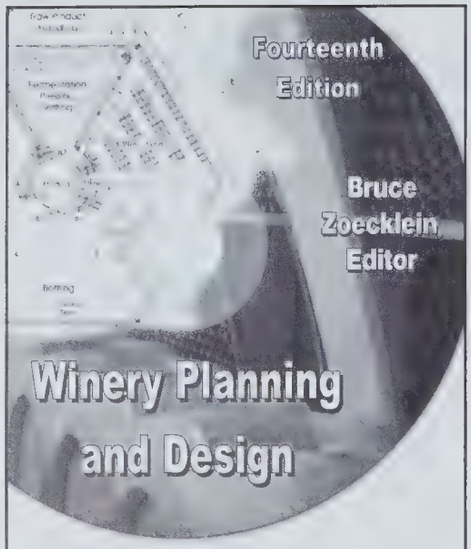

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UCCE releases costs of growing grapes

Fourteen new cost-of-production studies for growing winegrapes, table grapes, high-density olives, fresh market tomatoes, onions, blueberries, apples (fuji), and dates, have been released by the University of California, Davis, and the UC Cooperative Extension (March 2008).

Each study is based upon a hypothetical farm operation using practices common in the region. UC Cooperative Extension farm advisors, growers, researchers, farm accountants, pest control advisers, industry consultants, and other agricultural associates provided input and reviews. Assumptions used to identify current costs and operations for the individual crops, material inputs, cash and no-cash overhead are described.

An analysis table shows profits over a range of prices and yields. Other tables show monthly cash costs for cultural operations; costs and returns per acre for material inputs; hourly equipment costs; and whole farm annual equipment, investment, and business overhead costs.

Two studies show the cost to establish a vineyard and produce wine grapes and there are four studies for table grapes:

Sample costs to establish a vineyard and produce wine grapes, Red Varieties — Cabernet Sauvignon, 2008, North Coast, by Glenn McGourty, Karen Klonsky, and Richard De Moura.

Sample costs to establish a vineyard and produce wine grapes, White Varieties — Sauvignon Blanc, 2008, North Coast, by Glenn McGourty, Karen Klonsky, and Richard De Moura.

Sample costs for Table Grapes, Thompson Seedless, 2007, San Joaquin Valley, by William Peacock, Stephen Vasquez, Jennifer Hashim-Buckey, Karen Klonsky, and Richard De Moura.

Sample costs for Table Grapes, Flame Seedless, 2007, San Joaquin Valley, by William Peacock, Stephen Vasquez, Jennifer Hashim-Buckey, Karen Klonsky, and Richard De Moura.

Sample costs for Table Grapes, Redglobe, 2007, San Joaquin Valley, by William Peacock, Stephen Vasquez, Jennifer Hashim-Buckey, Karen Klonsky, and Richard De Moura.

Sample costs for Table Grapes, Crimson Seedless, 2007, San Joaquin Valley, by William Peacock, Stephen Vasquez, Jennifer Hashim-Buckey, Karen Klonsky, and Richard De Moura.

The cost studies are available online at http://coststudies.ucdavis.edu, at county UCCE offices, by mail from the University of California, Department of Agricultural & Resource Economics, One Shields Ave., Davis, CA 95616; or may be requested by phone: 530/752-1517. Internet downloads are free. There is a $3 handling fee for each mailed report. ■

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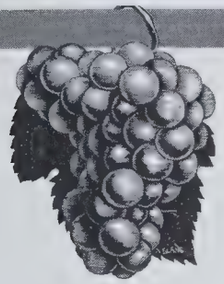

Advanced post-bottling chemistry research to improve winemaker control

Nomacorc, a leading producer of alternative closures, has assembled a team of internal experts who are partnering with three wine research institutions to determine how oxygen transfer through closures influences wine evolution after bottling.

Under Nomacorc sponsorship, researchers at the University of California (Davis), The Australian Wine Research Institute, and the Institut National de la Recherche Agronomique (France), together with Nomacorc wine scientists, have initiated a three-year project focused on understanding changes in wine chemistry under different oxygen exposure conditions.

To ensure that oxygen through the closure is consistent and predictable, uniquely designed ageing vessels (created to alter the oxygen environment under which the wines are stored, hence broadening the range of OTRs under study) will be sealed with Nomacorc closures selected based on oxygen transfer rates (OTR).

White, rosé and red wines will be studied, with each academic institution focusing on wines common to its specific region. Winemaking will be performed using many techniques with each wine aged under predetermined and highly-controlled oxygen conditions.

Ultimately, for every grape pressing, up to 16 different wines will be produced. Using distinct chemical markers, researchers will map the impact of oxygen on wine chemistry development and the corresponding influence on sensory attributes governing aroma, taste, mouth feel, and color.

Preliminary research results may be published in the latter part of 2008. With this knowledge, Nomacorc will be able to translate winemakers' desired sensory attributes into optimum closure design based on required OTR. Winemakers will benefit from improved closure performance, and can integrate closure design into their winemaking techniques.

Although this research utilizes Nomacorc closures exclusively, the findings relate in broader terms to OTR-impact on wines, and will have direct relevance to other closure designs.

The desired result is to improve winemaker control of wine development after bottling, and enhance wine quality.

1. Clone 14
2. Clone 17
3. Clone 22
4. Clone 96

Photos from Chalk Hill trials.

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Chardonnay

PART II

CLONAL DEVELOPMENT

Chardonnay selections maintained in the FPS collection reflect a large and diverse pool from which growers and winemakers can choose for varietal wines or blending materials. California has created its own selections from the Chardonnay clones imported from France in the 19th and 20th centuries. Clonal variation has been captured in selections collected from different climate and topographical regions within the state.

Part I (March/April-2008) discussed California and Washington clones.

Mt. Eden Clones

Chardonnay FPS 27, 28, and **66** are field selections that originated from a Chardonnay vine not derived from the Wente Vineyard (Livermore, CA).

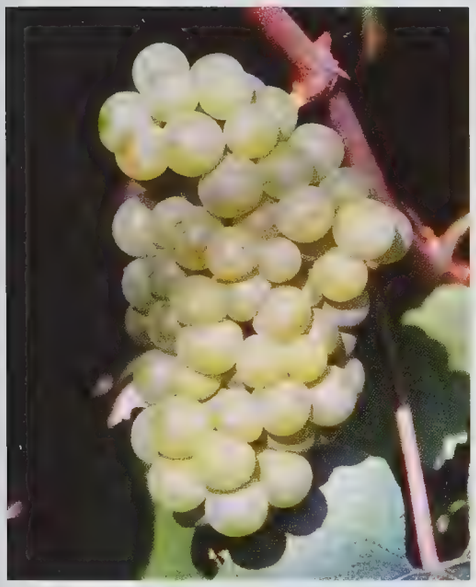
Paul Masson immigrated to San Jose, CA, in 1878 and established the La Cresta Vineyard & Winery in the Santa Cruz Mountains. Winegrapes have been grown in that mountain appellation region since the 1860s, and Chardonnay's value as a base for sparkling wines was recognized by Masson and others at the turn of the century.[11] Masson imported Chardonnay plant material from Burgundy about 1896.

Martin Ray took Chardonnay cuttings from the Paul Masson property and planted them in a new vineyard property on a nearby 2,000-foot peak called Mt. Eden in the Santa Cruz Mountains in 1943. Chardonnay from that vineyard is called the "Mt. Eden clone" that has been described as "a low-yielding, virus-infected selection with small berries and tight clusters."[25] Two wineries that have had success with this clone are Matanzas Creek Winery and Simi Winery (both in Sonoma County).

Chardonnay FPS 27 and 28 were donated to the FPS public collection by Matanzas Creek Winery (1984). Merry Edwards was the winemaker at both Mt. Eden Vineyards (1974–1977) and Matanzas Creek (1977–1984) and took Mt. Eden plant material to Matanzas Creek.[14] Matanzas Creek donated to FPS "Matanzas Creek Mt. Eden Vineyard clones 1 and 2" that underwent 61 days of heat-treatment. Selection 27 was registered (1992), and selection 28 (1994).

Chardonnay FPS 66 was collected in 1994 by FPS Director Deborah Golino from a newly developed Chardonnay block, planted by Simi Vineyards about 1990, on Piner Road in Russian River Valley. The source of the Mt. Eden clone plant material was Larry Hyde's vineyard in the Carneros region (Napa County). Simi had previously made wine from the Hyde grapes and appreciated the wine for its intensity and depth of feel.[22]

Zelma Long reports that the vines from the Hyde vineyard were productive and describes the wine from the Hyde excellent quality grapes as having "depth and power and texture."[9] Dr. Golino, Diane Kenworthy, and Simi winemaker Zelma Long selected four vines from the Mt. Eden clone block at



Novavine VCR 10 (FPS clone 103)

Simi. One of those vines evolved into Chardonnay FPS 66. Upon its arrival at FPS, selection-66 tested positive for virus and underwent shoot tip tissue culture treatment for virus elimination and was registered (1999).

French Clones

Recent imports from Europe have increased the clonal diversity of Chardonnay plant material available in California. Chardonnay is the leading white wine grape variety in France, where it is grown in Burgundy, Champagne, the Languedoc, and other areas.

In the French system, clonal material is subjected to extensive testing and certification. There are 28 Chardonnay clones officially certified by the French Department of Agriculture.[1] Some of the more popular French clones are ENTAV-INRA® 96 (most frequently propagated), 76, 95, 277, and 548. Clones 77 and 809 are popular French clones of the *musqué* type.

In the mid-1980s, the Oregon Winegrowers Association and Oregon State University (OSU) collaborated on a project related to a mutual interest in European clonal material. California Chardonnay clones (in particular, selection 108, also known as Chardonnay FPS 04 and 05) did not ripen in a timely manner in Oregon.

David Adelsheim (Adelsheim Vineyard, Oregon) and Ron Cameron (OSU) worked together and established relationships with Professor Raymond Bernard, viticulturalist and regional director at the Office National Interprofessionnel des Vins (ONIVINS) in Dijon, France, and Alex Schaeffer at the Station de Reserches Viticoles et Oenologiques, INRA, Colmar, France.

The OSU program (no longer in existence) imported eight French Chardonnay clones selected by Bernard from Burgundian vineyards. In response to interest from the California grape and wine industry, OSU agreed (1987–88) to make some of the French Chardonnay clones ("Dijon clones")

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available for the public collection at FPS.

French clones sent to FPS from OSU are public and considered "generic." The source for generic French clones is indicated on the FPS database with the following language: "reported to be French clone xx." This is used to distinguish generic clonal material from trademarked clones authorized by the Etablissement National Technique pour l'Amelioration de la Viticulture (ENTAV) sent from official ENTAV vineyards and other sources. Generic clones are assigned an FPS selection number that is different from the reported French clone number. There is no guarantee of authenticity for generic clones.

Generic clones that came to FPS from Dijon via OSU are included in the official French catalogue of certified clones. The reported French source and corresponding selection numbers used to identify these materials at FPS are French 76 (FPS 69), French 77 (FPS 44 and 45), French 78 (FPS 39), French 96 (FPS 70), French 352 (FPS 41), and French 277 (FPS 42, 49 and 51). French 352 was from l'Espiguette and the other clones were from Dijon.

When the plant material arrived at FPS (1987-88), the California R&C Program regulations provided that RSP+ (tested positive for Rupestris Stem Pitting virus) plants could not come out of quarantine. The RSP+ OSU Chardonnays all underwent shoot tip tissue-culture treatment. The selections mentioned above appeared on the FPS Registered list gradually, between 1997 and 2002.

ENTAV was the first foreign entity to contract with FPS for Chardonnay importation services. ENTAV is an official agency certified by the French Ministry of Agriculture and responsible for management and coordination of the French national clonal selection program. ENTAV maintains the French national repository of accredited clones and has created an ENTAV-INRA® authorized clone trademark to identify its official clonal materials internationally.

This trademark is a good indication that the clonal identity of a vine is correct. Trademarked importations come directly from official French source-vines. ENTAV retains the exclusive rights to control the distribution and propagation of its trademarked materials, which are only available to the public from nurseries licensed by ENTAV (as of this writing: California Grapevine Nursery, Herrick Grapevines, and Sunridge Nursery).

Selection numbers used to identify ENTAV-INRA® authorized clones in the FPS collection equate to the same numbers used by the official trademarked clones. Three trademarked Chardonnay clones sent to FPS (1997) are labeled: authorized Chardonnay ENTAV-INRA® 76, 96, and 548 and Chardonnay FPS 76, 96, and 548, respectively. The three selections were registered in the California R&C Program for Grapevines (2000).

Laurent Audeguin (ENTAV) summarized the performance of these three FPS-registered selections. ENTAV-INRA® 76 is a regular clone in terms of production and quality; the wines obtained are representative of the variety: aromatic, fine, typical, and well-balanced. ENTAV-INRA® 96 demonstrates good vigor and high yield; the wines obtained are aromatic, elegant, and sharp. ENTAV-INRA® 548 has lower than average yield due to small and loose clusters with high sugar potential; the wines are aromatic, complex, and concentrated with good length. All three selections have good ageing potential if yield is controlled.[1]

Chardonnay is key to many fine sparkling wines. Domaine Mumm contracted with FPS to import five Chardonnay clones from Champagne Perrier-Jouet, France (1988) for the

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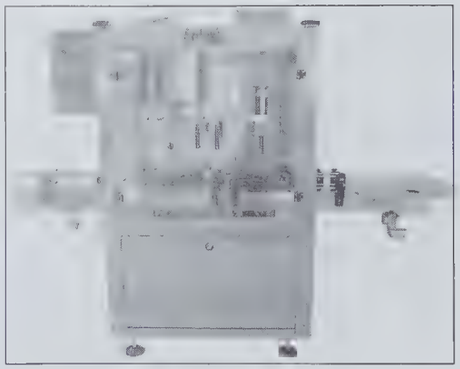

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Domaine Mumm vineyards and the FPS public collection. None of the importations were duplicates of other registered FPS selections. This contract was entered into prior to the ENTAV-INRA® trademark program, so the clones are generic clones and contain the reference "reported to be French xx."

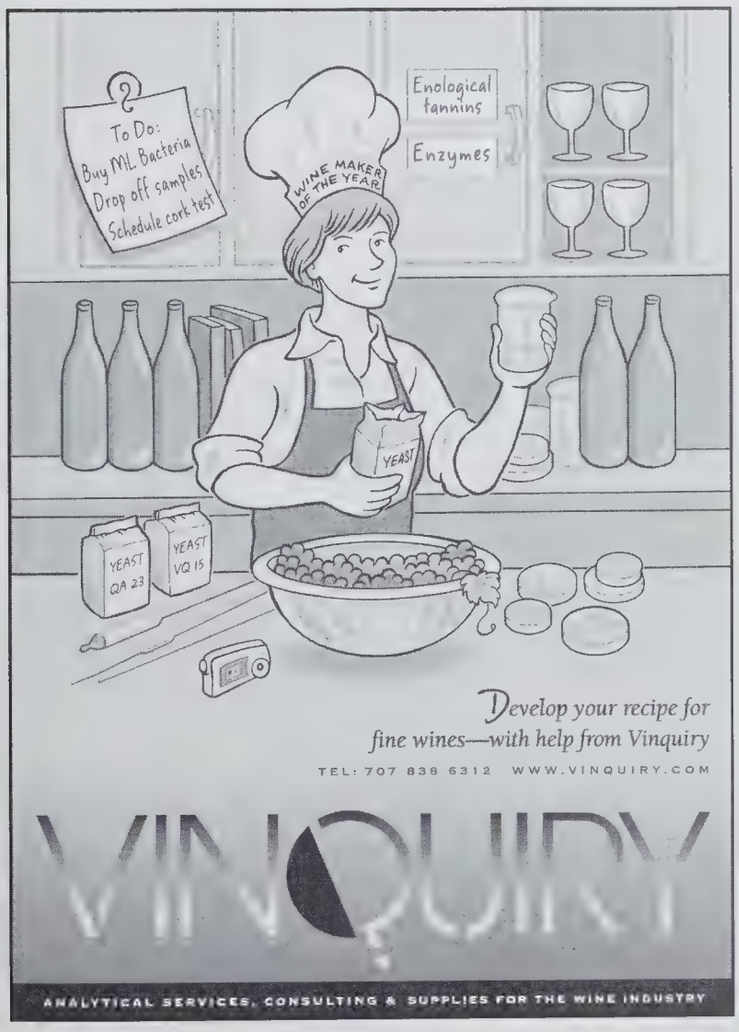
The imported clones with the (FPS selection number) behind the reported French clone number are: French 75 (FPS 43 and 46), French 95 (FPS 37 and 38), French 116 (FPS 83), French 117 (FPS 81), and French 125 (FPS 40). All selections underwent shoot tip tissue-culture treatment for virus elimination and first appeared on the FPS Registered list in 1997 (FPS 37, 38, and 46), 1998 (FPS 43), 1999 (FPS 40), and 2002 (FPS 81 and 83).

Some French clonal material available in the OSU, ENTAV, and Domaine groups has been included in California research trials. Larry Bettiga (UC Cooperative Extension farm advisor) evaluated French clones 75, 76, 78, 95, and 96 in a Pacific Vineyard trial (Monterey County). French clones 76, 95, and 96 were in the moderate to high yield group with Chardonnay FPS 05, but were more consistent in performance over the years. Clones 95 and 96 had many moderate to large berries per cluster.

Bettiga found that, under cool bloom conditions, berry set and development were very uniform. Vine vigor and °Brix were higher than FPS 04 and 05. Clones 76 and 78 had more low weight clusters with fewer berries than 95 and 96. Clone 75 yielded medium cluster weights with above-average numbers of small berries per cluster. Vine vigor was weak to moderate.[2]

Matthew Fidelibus (UC Cooperative Extension viticulture specialist), included French clone 95 (Chardonnay FPS 37) in a Fresno County trial. The average yield for the four-year period was 23.2 kg/vine, which was not significantly different than FPS 04 and 06. Clone 95 yielded the highest average number of clusters per vine but produced an average cluster weight (0.24 kg) compared to FPS 04 (0.29 kg) and FPS 15 (0.20 kg). Although berry weight for all three selections did not differ significantly, the number of berries per cluster for clone 95 was lower than FPS 04 and higher than FPS 15. Clone 95 had similar °Brix and pH levels as FPS 15, with lower titratable acid than both FPS 04 and 15. Clone 95, like FPS 04, often exhibited a high incidence of sour rot in the warm climate.[6]

The Chalk Hill trials (Sonoma County) included some French clones. In 1996, Clone 75 yielded a low 5.4 tons per acre, but the wine was highly rated as rich and concentrated. Clone 95 had the highest yield (6.4 tons per acre) of the four French clones and produced a "rich, well balanced wine." Clone 95 was one of the five most preferred clones from 1996. Clone 96 was the



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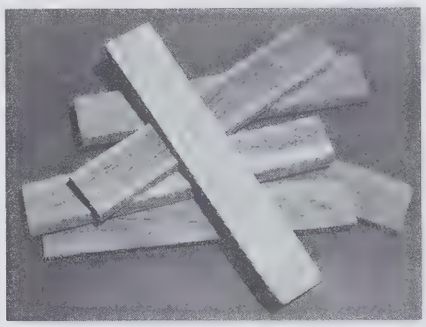

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least-preferred. Clones 78 and 352 produced moderate to high yields and good quality wines.[7] The French clones have been included in ongoing Chalk Hill trials.

Gloria Ferrer (Sonoma, CA) vineyard manager Mike Crumly and winemaker Bob Iantosca traveled to Champagne (1987) and met the clonal research staff for the Comité Interprofessional des Vins de Champagne (CIVC). The CIVC offered them cuttings from the plant material of their choice.

Gloria Ferrer arranged for the Saanichton Plant Quarantine Station (British Columbia, Canada) to import six Chardonnay clones from CIVC (Epernay, France), in 1989. (FPS importation services were very limited then, while new quarantine facilities were under construction). Saanichton shipped these clones to Gloria Ferrer (1993) after completing all tests to qualify them for certification in Canada.

In 1996, Gloria Ferrer generously donated cuttings from the six clones to the FPS public collection. FPS performed shoot tip tissue-culture virus-elimination procedures on all the clones and qualified them for the R&C Program between 2002 and 2004. The reported French clone sources and their corresponding FPS selection numbers are: French 118 (FPS 104), French 121 (FPS 99), French 124 (FPS 84 and 98), French 130 (FPS 82), French 131 (FPS 100), and French 132 (FPS 85).

Another group of French clonal material was imported to UC Davis by Dr. Austin Goheen for Far Niente Winery (1981). The material is reported to be French clonal material from a grower named Fetzmann (Cote d'Or, France). Four separate plants are represented by this group, which are now part of the FPS public collection.

Chardonnay FPS 48 and **50** are from the same clonal material that was labeled "clone 2" by the importer; and underwent both heat-treatment (109 days) and shoot tip tissue-culture treatment, and first appeared on the FPS Registered list in 1997. **FPS 54** (designated "clone 4" in the shipment) underwent heat-treatment (60 days) and tissue-culture procedures and was registered (1999).

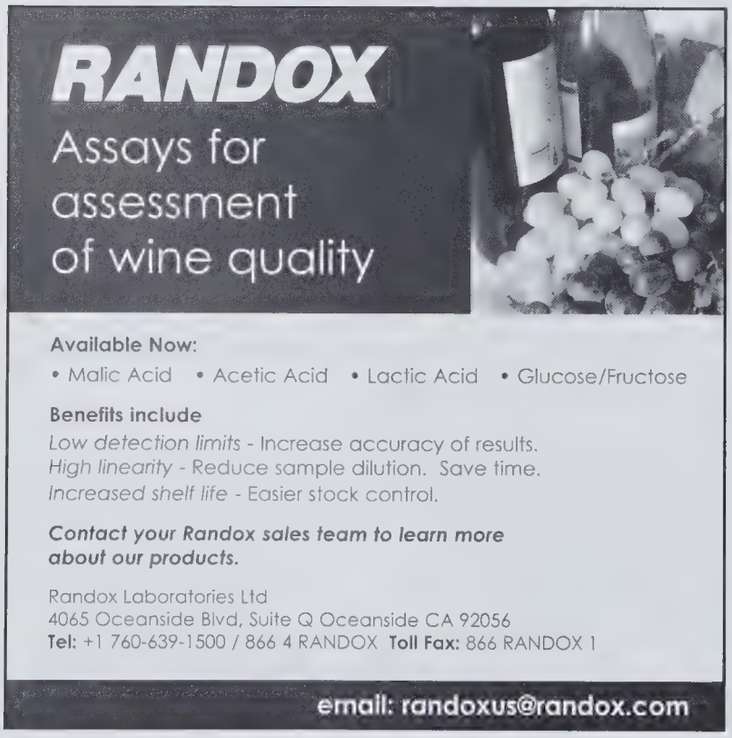
FPS 71 was created using tissue culture (after heat-treatment) from the original Burgundian clone and appeared on the FPS Registered list in 2001. **FPS 73** ("clone 3" in the shipment) underwent both heat-treatment (78 days) and tissue-culture procedures, and was registered (2002).

Italian Clones

Chardonnay migrated to Italy in the Middle Ages or Renaissance periods. The first documented evidence (in the 1700s) of the variety in Italy occurred in connection with the Medici family, who facilitated importation of French wine varieties including a "Pineau from Bourgogne."[8] The first "official" cultivations of Chardonnay began in the last half of the 19th century primarily on the sub-alpine slopes in northern Italy in order to improve the quality of Italian wines.[4,8]

Pinot bianco (Weissburgunder) and Chardonnay (Gelber Weissburgunder) were cultivated together and treated alike in Italy for a time. Field trials conducted between the two world wars at the Istituto Sperimentale Viticoltura in the Veneto region of northeast Italy (Conegliano) raised Chardonnay's profile in northern Italy. The two varieties were clearly separated in 1978 in the National Catalogue of Wine Varieties.[3]

Four Chardonnay selections received by FPS from Conegliano, Italy (1984), were labeled Congeliano 6, 7, 10, and 11 and became Chardonnay FPS 20, 21, 22, and 23, respectively. All four tested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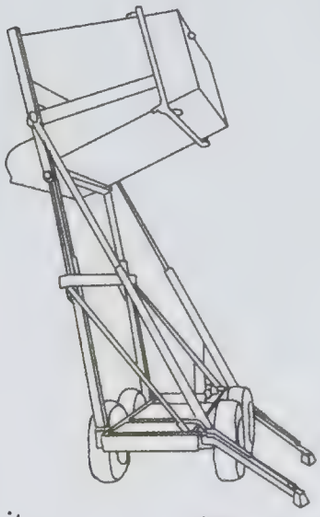

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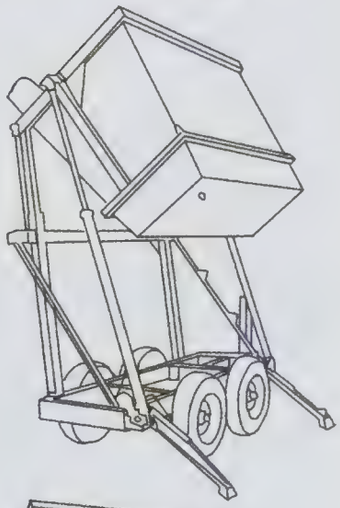

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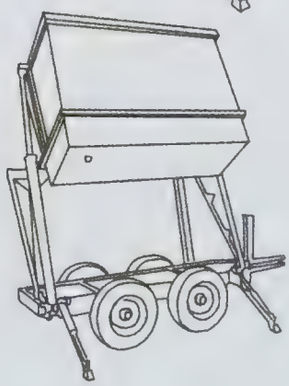

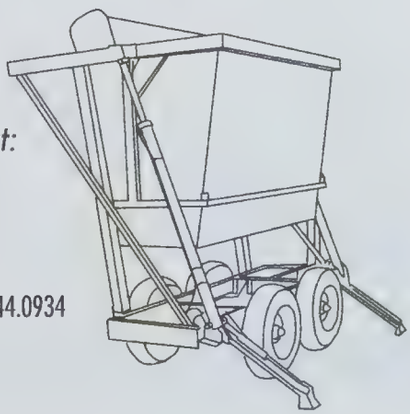

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negative for virus and were not treated. They first appeared on the FPS Registered list in 1990.

The FPS Conegliano clones were evaluated in several clonal trials in California. Larry Bettiga put FPS 20, 22, and 23 in a Pacific Vineyard trial (Greenfield). FPS 22 and 23 had lower yields, attributed to erratic fruit set resulting in low berry weights and fewer berries per cluster, plus shot berries. FPS 20 had large berries, moderate yields, and lower °Brix than other selections.[2] FPS 20 performed in the same relative fashion in the Fresno trial.[6] FPS 22 showed high vigor but scored in tier-1 in the wine portion of the Chalk Hill trial in Sonoma.[7]

Chardonnay FPS 74 (SMA 127 in Italy), came to FPS from Dr. Antonio Calò of the Istituto Sperimentale at Conegliano (1988). It tested RSP+ and underwent shoot tip tissue-culture treatment before appearing on the registered list (1998). Literature from Italy describes SMA 127 as a grape with excellent yield, average size clusters, high acidity and sugar content in the must suitable as a base for sparkling wine.[4]

Another group of Italian Chardonnay selections came from one of the first international entities to contract with FPS for grape importation services: Vivai Cooperativi Rauscedo (VCR) in Italy. VCR is a private nursery cooperative formed 70 years ago and currently has an annual production capacity of over 60 million vines. More than 30 years ago, VCR started its own clonal selection program which includes micro-vinification for evaluating winegrape clones.

In 1997, VCR formed a joint venture with NovaVine Grapevine Nursery (Santa Rosa, CA), making NovaVine the exclusive U.S. producer and distributor of the private VCR clones. There are currently three privately controlled VCR Chardonnay clones at FPS: designated SMA 108 (FPS 86), VCR 10 (FPS 103), and VCR 4 (FPS 105), all of which were registered in 2004. Tom Nemcik of NovaVine explains that "the VCR 4 clone is characterized as a *Musqué* because of its delicate perfume and taste of muscat."[26]

Chardonnay FPS 18 came to FPS in 1983 with the designation "Rauscedo 8" and is now in the public collection. That selection did not undergo any treatment and was registered (1987). FPS 18 was included in some clonal trials in California.

In Monterey County, FPS 18 produced moderate yield with moderate weight clusters.[2] In Fresno, FPS 18 was in the higher yielding group (22.6 kg/vine) but in the intermediate group for clusters per vine, cluster weight, berries per cluster, and berry weight. It exhibited a high incidence of sour rot.[12] In Sonoma County, FPS 18 produced high yield and early sugar accumulation but did not score highly in the still wine tasting category.[19] This clone is used successfully in Italy as a base for sparkling wine.

Other Foreign Clones

Chardonnay FPS 16 was imported from Australia's Rutherglen variety collection (1970) and given USDA Plant Identification (P.I.) #364283. The selection tested negative for virus at FPS, but underwent heat-treatment for 60 days. FPS 16 was registered (1980).

In 1990, Dr. Jean-Michel Boursiquot (ampelographer), examined FPS 16 and opined that it looked different than the characteristic Chardonnay vine and was possibly a tetraploid. In the 1996 *FPS Grape Program Newsletter* it was announced that, effective November 1996, FPS 16 would be placed "on hold" due to its off-type appearance. "Hold status" indicates that FPS no longer supplies propagation wood of a selection to customers unless the customer specifically requests it, after being informed of potential issues related to the selection. Chardonnay FPS 16 retained its registered status while it was on "hold" status.

Chardonnay FPS 16 was one of a group of Chardonnays subjected to DNA testing (microsatellite marker comparison analysis) in 2002. The results showed that Chardonnay FPS 16 did not differ in a significant way from the microsatellite marker profiles of other Chardonnays in the analysis.[12] Dr. Andrew Walker (professor in the Department of Viticulture & Enology), states that Chardonnay FPS 16 resembles traditional Chardonnay morphology enough to identify it as a Chardonnay, but suggests that FPS 16 exhibits clonal variation (leaves with sharper teeth; noticeably larger berries).[15]

Chardonnay FPS 25 arrived at FPS from the Geisenheim viticultural research institute (Germany) in 1984 with the designation "Geisenheim selection #1-12." The selection tested negative for virus and was registered (1990).

Summary

Additional Chardonnay selections now in the pipeline show promise. Sources of Chardonnay imported from Europe and Australia have increased the clonal diversity available to California growers and winemakers. Chardonnay has earned its reputation for adaptability and resilience by its performance in California. ■

Acknowledgments

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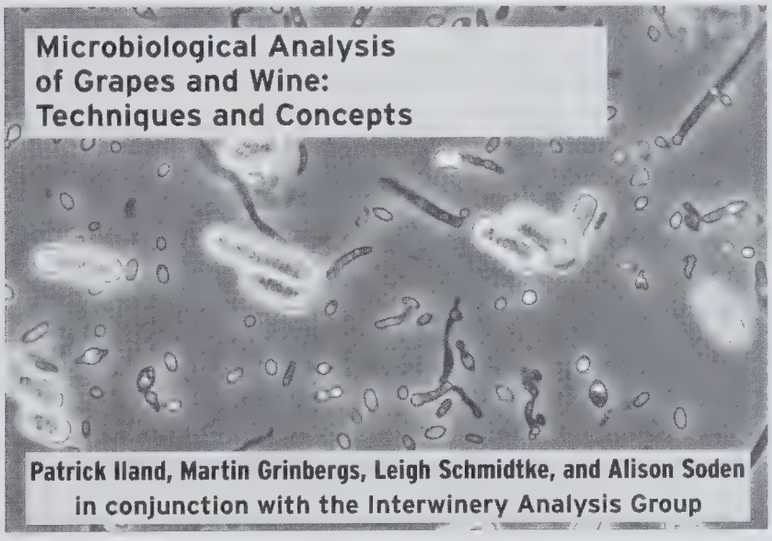
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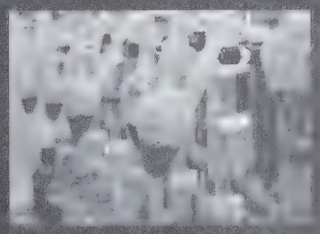

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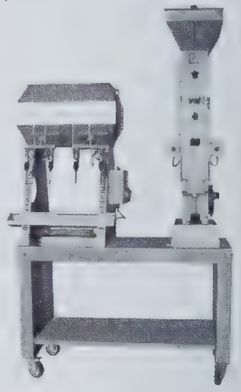
Napa Fermentation has an extensive array of winemaking supplies, including:
- Winemaking kits and ingredients;
- Wine yeast, nutrients, and malolactic cultures;
- Stoppers, bungs, spigots, wine hose, tubing;
- Labware, refractometers, and chemicals;
- Wine thieves;
- Oak products;
- Fermentation locks, buckets, and fermentors.

Napa Fermentation offers Lalvin fermentation supplies, including 23 strains of wine yeast and enzyme products. Malolactic bacteria include: Chr. Hansen Viniflora Oenos, Chr. Hansen CH 16, and Chr. Hansen CH35. Yeast nutrients include Fermaid K and Super Food.

Also available is a full line of Zambelli winemaking equipment including crushers (up to 14 tons per hour), membrane presses, electric hydraulic presses, bladder presses, bottle fillers, auto corkers, pressure-sensitive labelers, plate filters, cooling units, pumps for light must, stainless steel fittings, and cam locks.



Napa Fermentation carries the Tivoli corking/filling machine, made of AISI-304 stainless steel, with four jaws for use with synthetic or natural corks (22, 24, or 26mm diameter). Stainless steel fittings, and Karcher hot and cold pressure-washers are also available.

For more information, contact:
Napa Fermentation Supplies
575 Third St., Bldg. A
(Inside the Napa Town & Country Fairgrounds)
PO Box 5839, Napa, CA 94581
tel: 707/255-6372; fax: 707/255-6462
e-mail: wineyes@aol.com
website: www.napafermentation.com

PLEASE SEE NAPA FERMENTATION AD, PAGE 62.

G3 Enterprises

G3 Enterprises and FILTROX are proud to offer TRIEX, an effective way to remove TCA taint from wine and other beverages. TRIEX is a patent-pending compound that removes TCA without damaging a wine's aroma or flavor.

TCA (trichloroanisole) is a serious problem for the wine industry, estimated to cost winemakers more than $200 million annually. TCA can be found in corks, oak barrels, storage tanks, and other winemaking equipment. Its moldy odor can be detected in wine at levels as low as 5 parts per trillion. Even at lower levels, it can affect a wine's taste and bouquet.

TRIEX is an inorganic compound that has received regulatory approval for treating wine, and is specifically engineered to remove TCA molecules.

TRIEX is also extremely effective in removing tribromoanisole (TBA) taint. TBA is a chemical contaminant similar to TCA and has a similar impact to wine. TRIEX has been used to remove TBA-taint from a commercial amount of client wine. Tainted wine sent through filter sheets containing TRIEX is more effective than earlier methods and does not change wine flavor.

For more information contact:
G3 Enterprises
502 E. Whitmore Ave., Modesto, CA 95358
tel: 800/321-8747
e-mail: g3closurecustomer.service@g3enterprises.com
website: www.g3enterprises.com

Randox Laboratories USA

The RX daytona belongs to the growing family of RX series analyzers from Randox. The RX daytona is a fully-automated clinical chemistry analyzer ideal for enzymatic testing of wine.

With time-saving, labor-saving, and cost-saving capabilities beyond other bench-top analyzers on the market, the RX daytona offers an attractive and space-saving solution.

The RX daytona is capable of handling 40 samples onboard, and can process up to 180 tests per hour. Pyrex reaction cuvettes and a low reagent volume requirement reduce running costs, while automatic re-run and pre-dilution capabilities for out-of-range samples improve time-saving.

In addition to the RX daytona, Randox Laboratories are proud to announce the launch of the RX Monza, a compact semi-automated analyzer with integral screen, keyboard, and printer for enzymatic analysis of wine in small wineries. The system comes with preloaded software, allowing selection of tests with the touch of a button, and like the larger RX daytona, stored calibration curves allow results to be calculated automatically.

L-malic acid, L-lactic, glucose/fructose, acetic acid, ammonia, potassium, and total antioxidant status reagent packs are available. All RX series instruments have the flexibility to be programmed for a wide range of wine tests in addition to those in the current test menu.

For more information, contact:
Randox Laboratories USA
4065 Oceanside Blvd. #Q
Oceanside, CA 92056
tel: 866/4-RANDOX, ext 214
fax: 866/726-3691
e-mail: randoxus@randox.com
website: www.randox.com

PLEASE SEE RANDOX LABORATORIES AD, PAGE 78.

Gusmer Enterprises

Chr. Hansen's new "mixed cultured" yeast blends combine Saccharomyces and selected non-Saccharomyces strains of yeast to mimic the desirable results of a "wild" fermentation under the secure conditions of an inoculated source. The concept and products have become a big success in major wine producing regions throughout the world.

"The non-Saccharomyces mixed cultured yeast strain showed very well in our Syrah yeast trails. For the second consecutive year, this yeast blend added complexity and structure over other yeast strains in the trial, and the differences became even more pronounced as the wines aged," said one California winemaker (2006).

Mixed yeast cultures are one of the best tools to improve the complexity and layers of aromas and flavors in wine. The non-Saccharomyces strains *Torulaspora delbrueckii* and *Kluyveromyces thermotolerans* were carefully selected for their flavor contributions. These strains are only active during the first few days of the fermentation, at which time the Saccharomyces strain becomes dominant and drives the fermentation to completion. Available in four different blends to accommodate a wide range of red and white wine styles.

Gusmer Enterprises offers the full range of Chr. Hansen bacteria, yeast, nutrients, and lysozyme, in addition to filter media, fining agents, enzymes, oak alternatives, and more.

Gusmer Enterprises, Inc.

For more information contact:
Gusmer Enterprises
West Coast: 640-D Airpark Rd.
Napa, CA 94558
tel: 707/224-7903; fax: 707/255-2019, **OR**
81 M St., Fresno, CA 93721
tel: 559/485-2692; fax: 559/485-4254
East Coast: 1165 Globe Ave.
Mountainside, NJ 07092
tel: 908/301-1811; fax: 908/301-1812
e-mail: sales@gusmerenterprises.com
website: www.gusmerwine.com

PLEASE SEE GUSMER ENTERPRISES AD, PAGE 22.

Koch Membrane Systems, Inc.

New from Koch Membrane Systems, Inc. (KMS) is the model WF-12 hollow fiber crossflow microfiltration (CMF) system designed specifically for use in wine clarification. This 12-cartridge system employs a new membrane that is sturdier and more productive than other membranes, and will process wine at up to 68 hl/hr.

With KMS crossflow filtration, a feed stream flows parallel to the membrane surface at high velocity, as compared to the perpendicular flow path employed in conventional depth filtration. By keeping suspended material from settling, crossflow filtration minimizes the build-up of solids on the membrane, delivering a high permeation rate, and maintaining stable throughput. CMF can be employed as a one-step process, eliminating the need for multiple diatomaceous earth filtration steps.

KMS systems are flexible, efficient, and gentle on wine due to minimal oxygen pickup and heating. The WF-12 is a fully automated system requiring little or no operator attention. Also available from KMS is the WF-6 which is either automatically or manually-operated for flows up to 45 hl/hr, and the manually-operated WF-3 which can process up to 27 hl/hr.

For more information, contact:
Koch Membrane Systems, Inc.
850 Main St., Wilmington, MA 01887
tel: 888/677-5624; fax: 978/694-7020
e-mail: info@kochmembrane.com
website: www.kochmembrane.com

PLEASE SEE KOCH MEMBRANE SYSTEMS AD, PAGE 107.

Laffort Oenologie

Laffort Oenologie is the worldwide manufacturer of a broad range of enological products, including yeast, bacteria, nutrients, tannins, enzymes, fining agents, and stabilizing agents.

Laffort's product, BIOLEES, is revolutionary. This polypeptide is the purified active agent in lees aging, producing a double effect of sweetening and giving roundness to a wine, while also producing a fining effect. It is useful for both red and white wines.

Lactoenos 450 PreAc is a new concept that combines a strain of *Œnococcus oeni* specially selected for its remarkable resistance to tough wine conditions (SO_2, pH, alcohol, and temperature) and high malolactic activity along with a special activator. Thanks to its cost/efficiency ratio, **450 PreAc** is perfect when results and cost matter.

Laffort has a new yeast strain **Zymaflore X-16** specifically for the purpose of tank-fermented Chardonnay. Even under difficult fermenting conditions (low turbidity, low temperature), **X-16** shows strong fermentative capabilities, fast kinetics, high alcohol tolerance (16%v/v), and low VA. This strain produces great fermentation aromas (esters) and makes very aromatic wines, complex (fruity, floral) with intense mouthfeel.

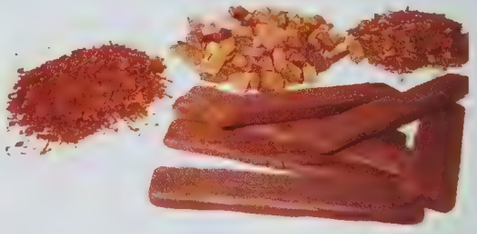
Laffort Research offers **Tanin VR Supra**, a fermentation tannin capable of precipitating proteins and thus protecting the natural skin tannins of grapes.

For more information, contact:
Laffort Oenologie
405 St. Andrews Dr., Napa, CA 94558
tel: 707/815-0225; fax: 707/251-5593
e-mail: russell.robbins@laffort.com
website: www.laffort.com

PLEASE SEE LAFFORT AD, PAGE 8.

Pickering Winery Supply

Pickering Winery Supply (PWS) distributes oak adjuncts from Suber-Lefort of Adelaide, Australia, which has 16 years' experience in turning French barrel-quality oak into tank planks, mini-staves, chips, flakes, and powder. It is the seasoning and toasting regimens of the oak that result in flavor profiles quite distinct from any others. In addition, Suber-Lefort works with many wineries to develop specialized flavor profiles to match the style of wine they wish to produce. Yellowtail, the most popular Austalian brand in America, buys almost exclusively from Suber-Lefort.



PWS distributes a special fining agent produced in Germany, Vinpur Special, based on casein. It offers a gentle way to remove astringency, brown pigments, and oxidized phenols in red and white wines. What makes it unique is that it uses cellulose as a carrier, giving the casein a larger surface area and making it disperse much more completely. The result is a powder that can be directly added to the wine and is very predictable, unlike regular casein. Many wineries now consider Vinpur Special an integral part of their winemaking.

For more information, contact:
Pickering Winery Supply
888 Post St, San Francisco, CA 94109
tel: 415/474-1588; fax: 415/474-1617
e-mail: info@winerystuff.com
website: www.winerystuff.com

PLEASE SEE PICKERING AD, PAGE 77.

Vintners Supply Company

Vintners Supply Company (VSC) is now offering the Beatest portable hand-held integrity tester for hydrophilic membrane cartridges, from Bea Technologies S.p.A. in Italy. VSC also offers the Beatest Plus portable model for larger housings.

VSC has been very successful offering the ***EUROPOR***® line of depth media manufactured by E. Begerow GmbH of Germany. VSC also offers the full line of Becodisc stack disc modules, beco compact plate filters, Beco Integra stack disc filter housings, and the Beco Integra Cart cartridge filter housings.

BEGEROW

VSC offers SIHA yeast and enzyme products, and Begerow wine and beer additives.

SIHA

VSC has replacement membranes for most makes and models of grape presses, and replacement cloths for all makes and models of filter presses.

VSC offers VSC proprietary cartridge filters. These filters are available in absolute, integrity testable formats, and nominal pore sizes from 0.1 to 70 microns. Cartridge filter housings are available from single cartridge to multiple round housings in sanitary stainless steel configuration.

For more information, contact:
Vintners Supply Company
Robert H. Moeckly
PO Box 153, St. Helena, CA 94574
tel: 800/366-6809; fax: 707/584-7955

PLEASE SEE VINTNERS SUPPLY CO. AD, PAGE 69.

StaVin Incorporated

StaVin is evolving the process of oak selection and usage. StaVin's Ph. D. scientists have developed a method for winemakers to rapidly evaluate the sensory effects of its three-year seasoned/fire-toasted oak in their wines.

These customization trials allow winemakers to assess the suitability of StaVin toast levels and oak origins in their wines. Furthermore, these samples can be blended to give an indication of sensory effects arising from oak blends and oak concentration.

This process enables a winemaker to make the appropriate oak choices for wines based on their sensory evaluation of resultant wine quality. StaVin uses this winemaking approach to oak selection rather than a marketing approach.

For more information, contact:
StaVin Incorporated
Alan Sullivan, Steve Sullivan, Dr. Jeff McCord, Dr. Jeff Murrell, Jamie Zank
PO Box 1693, Sausalito, CA 94966
tel: 415/331-7849; fax: 415/331-0516
e-mail: info@stavin.com
website: www.stavin.com

PLEASE SEE STAVIN AD, PAGE 17.

Maurivin/Mauriferm

Maurivin, in collaboration with The Australian Wine Research Institute (AWRI), has successfully developed wine yeast that will not produce hydrogen sulfide. "Our objective was to eliminate reductive aromas in winemaking," says Nick Yap, Maurivin global director. "This was a very ambitious goal. The ability to eradicate yeast-derived hydrogen sulfide is a landmark development in winemaking."

Maurivin and the AWRI used non-GMO strain development techniques to develop three new proprietary yeast; Platinum, Distinction, and Advantage. These yeast have a "defunct" sulfite reductase enzyme, that will not make any detectable hydrogen sulfide, even when fermenting juice with low nitrogen content, have a strong fermentation capacity, and the ability to enhance varietal characters.

"When using these yeast," Yap notes, "winemakers now can be assured their wines will be free of any yeast-derived reductive characters. This ensures the full varietal expression of their wines."

maurivin next generation

The new revolutionary yeast are part of Maurivin's new innovative range of "Next Generation" wine yeast, that includes the latest in hybrid yeast: AWRI 1503 and AWRI Fusion. The non-GMO yeast combine the strong fermentation capacity and ease-of-use properties of PDM, with the enhanced mouth-feel and increased complexity of indigenous yeast.

Maurivin also offers its popular "Classic" range of wine yeast, and a range of Mauriferm fermentation aids.

For more information, contact:
Maurivin/Mauriferm
c/o Pacific Coast Chemicals
2424 Fourth St., Berkeley, CA 94710
tel: 510/549-3535; fax: 510/549-0890
e-mail: steveshaffer@pcchem.com
website: www.pcchem.com, or www.maurivin.com

PLEASE SEE MAURIVIN YEAST AD, PAGE 13.

Demptos Napa Cooperage

Demptos is proud to release three new ultra-premium "Oak in Wine" barrel alternative products. Backed by Demptos' own research department, headed by Dr. Nicolas Vivas, Demptos now produces its own oak powders, oak chips, and oak granulates. These enological tools are custom-roasted to order and shipped directly from Bordeaux, France to the cooperage and distribution hub in Napa, CA.

oak in WINE
by DEMPTOS

Order the "P"-Series (oak powders), "E"-Series (oak chips), and "F"-Series (oak granulates or smaller chips) in three different toast/roast levels including Untoasted (L.70), Medium Toast/Roast (L.40) or Heavy Toast/Roast (L.20).

Please contact your Demptos representative for more information and usage recommendations, or contact Demptos Napa Cooperage for product samples and available stock. Order early for Harvest 2008 demands.

For more information, contact:
Demptos Napa Cooperage
1050 Soscol Ferry Rd., Napa, CA 94558
tel: 707/257-2628; fax: 707/257-1622
website: www.demptos.fr
CA, OR, WA, Mexico: Mark Heinemann, Sales Manager/Enologist
cell: 707/738-0813
e-mail: mark@demptosusa.com
CA, TX, NM, AZ, CO, MI, ID: Julie Guffy
cell: 707/694-6270
e-mail: julie@demptosusa.com
U.S. East Coast: Tom Payette
tel: 540/672-0387
e-mail: tpayette@ns.gemlink.com
Canada: Michael Dine
cell: 503/784-6527
e-mail: michael@imezzo.ca

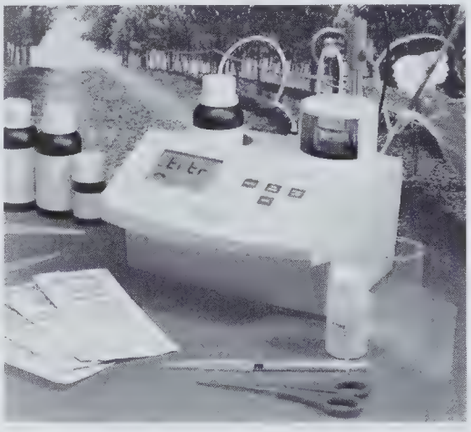
PLEASE SEE DEMPTOS NAPA COOPERAGE AD, PAGE 65.

Hanna Instruments

Hanna Instruments offers the HI-84100 mini-Titrator for determination of free and total sulfur dioxide for wine analysis. The HI-84100 is a low-cost, easy-to-use, microprocessor-based automatic titrator that benefits from Hanna's years of experience as a manufacturer of analytical instruments.

The HI-84100 has a simple and reliable peristaltic pump to ensure accurate dosing and repeatability. By performing pump calibration with the provided Hanna standards, instrument accuracy is assured.

This instrument is supplied with a preprogrammed analysis method designed for free and total sulfur dioxide measurements on wine samples. The instrument features a powerful and effective built-in algorithm to analyze the shape of the electrode response curve and to determine the reaction completion. This algorithm automates the analysis and makes all necessary calculations.



The interface of the HI-84100 is clean and simple. By simply pressing the START/STOP button, the instrument will automatically make the titration up to the equivalence point. The result is immediately displayed in convenient units; then the instrument is ready for another titration. The Hanna HI-84100 offers the possibility to quickly and accurately test free or total SO_2 in all wines (including red).

For more information, contact:
Hanna Instruments
584 Park East Dr., Woonsocket, RI 02895
tel: 800/426-6287; fax: 401/765-7575
e-mail: wine-brew@hannainst.com
website: www.hannainst.com/USA

PLEASE SEE HANNA INSTRUMENTS AD, PAGE 38.

Bentonite Performance Minerals

A world leader in production of Wyoming bentonite, a benchmark in the global sodium bentonite industry, Bentonite Performance Minerals (BPM)'s mission is to develop, market, manufacture, and support the finest bentonite products in the world. BPM products are leaders in a range of industrial, specialty, consumer, and environmental markets worldwide. BPM was the first Wyoming bentonite producer to achieve ISO registration at all manufacturing locations. BPM is licensed to use the API monogram labeling on its API bentonite products.

FINING AGENT:

VITIBEN® fining agent is made of the purest bentonite and produces superior clarity and heat stability that fine wines deserve. VITIBEN is designed to "fine" or remove undesirable compounds from wine and juices. These compounds include phenolics, proteins, and tannins, which are present in the fruit or result from natural enzyme reaction during processing and aging.

BENTONITE
Performance Minerals LLC

BENEFITS:

- Superior dispersibility;
- Easier handling;
- Higher yields;
- Higher activity;
- Longer equipment life.

VITIBEN fining agent is listed by the Food and Drug Administration as Generally Recognized As Safe (GRAS). VITIBEN is certified as Kosher by the Scroll K.

Purchase VITIBEN directly from one of Bentonite Performance Minerals' agents: Brenntag Pacific, Inc., 559/268-4571, Gusmer Enterprises, 559/485-2692, or Pacific Coast Chemical, 510/549-3535.

For more information, contact:
Bentonite Performance Minerals LLC
3000 N. Sam Houston Pkwy East
Houston, TX 77032
tel: 281/871-7900; fax: 281/871-7940
website: www.bentonite.com

PLEASE SEE BENTONITE PERFORMANCE MINERALS AD, PAGE 59.

VINQUIRY, INC.

Vinquiry offers a large selection of fermentation and specialty winemaking products, labware, and sanitation monitoring supplies. The following are new products for 2008:

Sniff Brett is a new product for detection of ethyl phenol-producing strains of *Brettanomyces*. Inoculate Sniff Brett vials with 20ml of wine, and "sniff" after the recommended incubation time to determine the presence of *Brettanomyces*. Sniff Brett also works with barrel scrapings to detect barrel contamination.

Vitilactic H+ 1-Step starter kit is a highly effective and easy malolactic bacteria (MLB) preparation for MLF in red and white wine where pH is low (2.9 and above). About one-half the cost of traditional freeze-dried bacteria strains, because acclimatization is done in the winery instead of during production. Vitilactic H+ 1-Step provides fast fermentations with good SO_2 tolerance.

Nutrient Vit END is Lallemand's latest treatment for stuck and sluggish fermentations. The presence of short- and medium-chain fatty acids and residual fungicides are possible causes of low yeast viability that can lead to stuck or sluggish fermentations. Nutrient Vit END is inactivated yeast with high bio-absorptive properties for these fatty acids and fungicides, along with waxy and soapy aromas.

For more information, contact:
Vinquiry, Inc.
7795 Bell Rd., Windsor, CA, 95492
tel: 707/838-6312; fax: 707/838-1765
Napa Office: 2025 Redwood Rd. Ste. 9
tel: 707/259-0740
Central Coast Office:
2717 Aviation Way Ste. 100
Santa Maria, CA 93455
tel: 805/922-6321
New! Paso Robles Office:
6305 Buena Vista Dr. Ste. 102
Paso Robles, CA 93446
tel: 805/591-3321
e-mail: info@vinquiry.com
website: www.vinquiry.com

PLEASE SEE VINQUIRY AD, PAGE 77.

O.C., INC.

Believing that there is no substitute for experience, O.C., Inc. provides the highest-quality toasted oak chips and barrel alternatives available. Natural extracts from these oak alternatives contribute to an improved bouquet and flavor of wine and spirits.

The batch-processed toasted oak chips and barrel alternatives are produced from the finest white oak in North America and France. The timber used is not a by-product of other processes, but is specially selected for O.C., Inc. products. The same timber is utilized and exported worldwide as cooperage material to produce barrels for aging of superb quality wines and spirits. A unique "slow-roasting" process ensures the most consistent barrel alternatives.

In order to provide customers the opportunity to choose the best and most appropriate barrel alternative for their desired application, O.C., Inc. offers a wide variety of products in American or French oak: Oak chips and powder, oak cubes, tank staves, barrel inserts, oak segments, oak-flavoring sticks, oak shavings, oak nuggets, VSOP, and NU-OAK. Check out the O.C., Inc. catalog at www.oakchipsinc.com.

For more information contact:
O.C., Inc.
191 Seif Road, Piketon, OH 45661
tel: 800/782-8310; 740/289-1251
fax: 740/289-1253
e-mail: ocinc@zoomnet.net
website: www.oakchipsinc.com

PLEASE SEE OC INC AD, PAGE 31.

KLR MACHINES

KLR Machines is a distribution partner for E. Begerow GmbH & Co., the German high-quality manufacturer of depth filter media and filtration equipment.

Product range comprises BECO depth filter sheets that have the least amount of ion migration coupled with the highest retention of particulate matter of any filter sheet in the wine industry. Sheet grades for wine range from K-1 at nominal 4.5 micron retention to Steril 40 through Steril 100 at nominal 0.1 micron retention.

BEGEROW

KLR Machines has Becofloc 7 and 10 and SIHA Isinglass, in stock.

"Begerow customers' end products are subject to very rigorous and precisely defined quality requirements. As part of the overall manufacturing process, depth filtration has to produce safely reproducible and therefore economic results," says Begerow owner Christa Tesch. "Begerow is geared towards producing and offering products and services of persistently outstanding quality."

For more information, contact:
KLR Machines
350 E. Morris St., Sebastopol, CA 95472
tel.: 707/823-2883
website: klrmachines.com

PLEASE SEE KLR MACHINES AD, PAGE 28.

Oenodev USA, Inc. — Group Vivelys

You may be familiar with the technique of micro-oxygenation (invented in France by Oenodev in 1990). It was introduced in the USA in 1996, and Oenodev has been promoting it ever since. You may also have discovered Oenodev's unique approach in the use of oak in wine, with the range of Boisé France oak chips.

Oenodev is now a lot more than oxygen and oak!

In 2008, with an expanded team in California, and as a member of the International Vivelys Group, Oenodev USA will provide many products and services to the wine industry:

1. Siryel: A precise tool for sensorial analysis enabling fast tasting and efficient decision-making;
2. Dyostem and Tevao: To plan the harvest of every block, at the moment of optimum aromatic and phenolic ripeness, according to a pre-defined product profile;
3. SmartCycler Cepheid, Brett Kit: Rapidly and easily trace micro-organisms present in wine;
4. Visio6 and cliqueur: Control all enological processes using reliable instruments, such as micro/macro-oxygenation;
5. Boisé France oak products (new DC310): A wide range of oak solutions corresponding to your product definition.

Call Oenodev USA to find out more about new cutting-edge technologies and consulting capabilities.

For more information, contact:
Oenodev USA, Inc.
Group Vivelys
1260 N. Dutton Ave., #240
Santa Rosa, CA 95401
tel: 707/546-2213; fax:707/542-6364
e-mail: usa@oenodev.com
websites: www.oenodev.com;
www.vivelys.com; www.boisefrance.com

Lallemand

Lallemand offers over 100 specific enological yeasts, selected from nature in response to the technical and stylistic goals of winemakers worldwide. This careful selection process allows the yeast to enhance and reveal the quality naturally present in the grapes. In North America, Lallemand offers over 50 of the more successful yeasts to meet creative needs while working within growing and winemaking practices.

Most yeast producers have been using similar technology for the last 25 years to grow and dry yeast even though the conditions that the yeasts are expected to perform under have changed considerably. Lallemand has been researching ways to prepare its well-known naturally selected yeasts to combat modern winemaking stresses from the first moments of their lives, before they leave the Lallemand facility.

YSEO® PROCESS
Yeast Security Optimization

For 2008, several popular Lallemand yeasts will be produced using the exclusive proprietary production process, **YSEO®**. **YSEO®** is short for **Y**east **SE**curity and **O**ptimization. **YSEO®** involves producing yeast from the growth phase to the drying phase, resulting in yeast better adapted to current winemaking practices. **YSEO®** yeasts are 100% natural and non-GMO to ensure the quality and security of fermentation.

For more information, contact:
Lallemand
Gordon Specht or Sigrid Gertsen-Briand
PO Box 5512, Petaluma, CA 94955
tel: 707/526-9809; fax: 707/526-9803
e-mail: gspecht@lallemand.com or
sigrid@lallemand.com
website: www.lallemandwine.us

PLEASE SEE LALLEMAND AD, PAGE 30.

Pall Corporation

The XL-C system is Pall's latest addition to its successful Oenoflow™ cross-flow filtration family of systems. Designed specifically for small wineries, this hollow fiber system enables removal of contaminants in a reliable, reproducible, and single process step. Available with either two or three modules, the automatic system provides typical throughputs ranging from 600 to 1,200 gallons per hour.

The large surface area, high flow-rate modules allow for manufacture of more compact and therefore more economical systems. The proven symmetric membranes, concentrate and filtrate tanks, touch screen controls and hardware are mounted on a mobile frame for easy integration into any wine process.

Similar to other Oenoflow™ models, clarification is achieved without the need for filter aids, centrifugation, or interference with the chemical, physical, and organoleptic characteristics of wine. Additionally, the XL-C system incorporates features unique to Pall including the patented Low Concentrate Volume (LCV) for maximum yield, Dynamic Solids Control (DSC) flow design for increased performance, and back-pulse for long filtration runs.

With introduction of the XL-C system, wineries of all sizes can reduce their operating costs and increase production yield while keeping absolute respect for the properties of wine. Pall wine filtration specialists are available to help select the optimum Oenoflow™ system to meet winery requirements.

For more information, contact:
Pall Corporation
Nicole Madrid,
Global Marketing Leader, Wine & Spirits
2200 Northern Blvd, East Hills, NY 11548
tel: 516/801-9137; toll free: 866/905-7255
fax: 516/625-3610
e-mail: foodandbeverage@pall.com

ATAGO U.S.A., INC.

For quality wines, use a quality refractometer. ATAGO is celebrating 68 years of designing and manufacturing reliable, accurate, and dependable refractometers for winemakers, vineyard owners, and grape growers. Digital hand-helds and benchtop models are available for use in the vineyard and quality control lab.

ATAGO's digital hand-held "Pocket" PAL-1 is perfect for field use, and is the #1 recommended refractometer of winemakers, not only in the U.S. but around the world. Ergonomically-designed for one-handed operation, and small enough to fit in a "Pocket," it quickly and accurately measures Brix. The PAL-1 features a digital display, automatic temperature compensation, and full-body water-resistant design.

For the lab, ATAGO offers the highly accurate RX-5000alpha (+/– 0.03% Brix) with a full Brix range from 0.00 to 100.00%, and an internal Peltier thermo module that controls the temperature of the sample, thus eliminating the need for an external water bath. Other useful features include a history function, and intuitive two-button operating system that saves the operator time when taking multiple sample readings. The RX-5000a is fast becoming a versatile and efficient addition to winery labs around the world.

In the field or in the lab, quality refractometers by ATAGO offer ease of use, and industry-renowned reliability.

For more information contact:
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With long-term aging in mind, ēvOAK by Oak Solutions Group introduces the Latitude Series, composed of three new tank staves (44° BORDEAUX, 45° RHONE, and 46° BURGUNDY) that let you apply a classic winemaking style to variety-specific, traditional wines.

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The 44° BORDEAUX is excellent for full-bodied red wines that have a deep affinity for elegant oak. Thanks to a specific infrared toast, layers of roasted coffee and dark chocolate integrate to create a true Bordeaux style. The 45° RHONE appeals to ripe, aromatic wines such as Syrah, Mourvèdre, and Grenache that need the support of smooth tannins. A moderate toast with low temperature reduces these tannins and creates a panorama of flavors. Use the 46° BURGUNDY for creamy, toasty oak and subtle smoke hints, reminiscent of Burgundy cooperage. Longest of the infrared toasts, this tank stave polishes the fruit and lengthens the palate.

Latitude Series tank staves are instruments designed for particular wines, and are of great assistance in giving certain varieties qualities of finesse and elegance. Bench trial sample kits for Bordeaux, Burgundy, and Rhône varietals are available at www.oaksolutionsgroup.com/samplekits.

For more information, contact:
Oak Solutions Group
Paul Abbott, Oak Solutions Specialist
2557 Napa Valley Corporate Dr., Suite D
Napa, CA 94558
tel: 707/259-5988; fax: 707/255-5952
e-mail: pabbott@oaksolutionsgroup.com
website: www.oaksolutionsgroup.com

PLEASE SEE OAK SOLUTIONS GROUP AD, PAGE 7.

May 4, May 28, June 26
AVF Regional Research Roadshows

The American Vineyard Foundation (AVF) has organized four Regional Research Roadshows to share the latest grape industry research with growers, winemakers, and allied industry. The roadshows are sponsored by the AVF, Viticulture Consortium West (VCW), and the California Competitive Grant Program for Research in Viticulture and Enology (CCGPVE) in partnership with local industry groups such as J. Lohr Vineyards. The workshops feature speakers from the University of California and the California State Universities.

"This is the first year the funding agencies have sponsored regional meetings, and they have been enthusiastically received by growers, winemakers, and researchers," says Deborah Golino, director of the VCW and CCGPVE, who has chaired the committee organizing the meetings. "The four programs are customized for each region with local University of California Cooperative Extension researchers and local industry stakeholders. Speakers are selected by local organizers from an extensive list of current ongoing research projects funded by the three agencies statewide."

The Central Coast Regional Research Roadshow, on May 6 will be at the Vina Robles Hospitality Center (Paso Robles). Speakers include: Dr. Andy Walker, Dr. Jim Wolpert, Larry Bettiga, Dr. Deborah Golino, Dr. Kent Daane, Menelaos Stavrinides, and Mark Battany. Advance registration is $45.

The Lodi Regional Research Roadshow on **May 28** will be at the Days of Wine and Roses Conference Center (Lodi) with free admission. Registration information will be available on the UC Integrated Viticulture online website and a special website (see below). Speakers include Dr. Hildegarde Heyman, Dr. Andy Walker, Dr. Matthew Fidelibus, Dr. Jim Wolpert, Mark Battany, Dr. Doug Adams, and others.

The San Joaquin Valley Regional Research Roadshow on **June 26** will be at the Armenian Cultural Center, 2348 Ventura, in Fresno. Speakers include Dr. Matthew Fidelibus, Dr. Bob Wample, Dr. Larry Williams, Dr. Mike McKenry, and others. Registration for the event before June 25 is $10 for members of the Central California Winegrowers or SJV Viticultural Group, or $25 for non-members. Registration at the door is $40. The program begins at 1:00 pm and culminates in a tasting of regional wines and hors d'oeuvres.

The North Coast Regional Research Roadshow, will be held in **August** in Santa Rosa (program under development).

For information about the Regional Research Roadshows as details develop, please visit http://ucanr.org/regionalreseachroadshows.

Established in 1978 to raise funds for research in viticulture and enology, the AVF is a wine-industry sponsored non-profit organization funded by growers and vintners. Since its founding, AVF has funded over $18 million in wine and grape-related research. For a complete listing of the funded research projects or more information regarding the AVF, visit their website www.avf.org or by e-mail to scott@avf.org.

Sustainable Winegrowing Practices Workshops

Pacific Gas & Electric (PG&E) is partnering with the California Sustainable Winegrowing Alliance to host workshops on energy efficiency, solar, biodiesel, green building, water and energy, greenhouse gas reductions, and more.

May 14, Wednesday
Energy Efficiency Workshop — Sonoma
8:30am–2:00pm
Sebastiani Vineyards & Winery — Sonoma, CA

Winery facility managers, vineyard managers, principles, chief financial officers and other personnel are invited to an energy efficiency workshop to learn about best practices for energy management in wineries and vineyards. Topics include: energy evaluation and planning strategies, renewable energy opportunities, PG&E incentive programs including free winery energy audits, equipment rebates, and technical support services, and how to develop an action plan to implement energy improvements.

May 20, Tuesday
Self-Assessment Workshop
Wente Vineyards Event Center
5050 Arroyo Rd., Livermore
9:00am–12:00pm

Livermore Valley Winegrowers Association and the CA Sustainable Winegrowing Alliance invite winery facility managers, principals, and other personnel to a workshop to assess their winery and/or vineyard operations using the Code of Sustainable Winegrowing Practices workbook. Attendees can determine the sustainability of their operations, and join hundreds of California vintners and growers who are improving sustainable practices through participation in the California Sustainable Winegrowing Program. Free lunch included. Participants who have done a previous Code of Sustainable Winegrowing assessment should bring their copy of the first edition with the mailed update packets inserted. First-time participants will receive the 500-page second edition of the Code of Sustainable Winegrowing Practices Workbook.

Registration and further information: Lisa Francioni, lisa@wineinstitute.org or 415-356-7545.

The RSVP form for the energy workshop on May 14 is at http://www.wineinstitute.org/energyworkshop.

June 10
Grapevine Leafroll Disease — Increasing Problem for California Vineyards
Freeborn Hall, UC Davis

8:30am Grapevine Leafroll Disease — Our State of Knowledge — Dr. Giovanni Martelli, Professor, (Istituto di Patologia Vegetale, Università di Sassari, Dipartimento di Protezione delle Piante), Università di Bari, Italy.

9:30am 15 years of observation of Leafroll Effects and Field Spread in California — Dr. Deborah Golino, Cooperative Extension Specialist (Plant Pathology Dept.), UC Davis.

10:45am Detecting Grapevine Leafroll and Vitiviruses — Dr. Adib Rowhani, Project Scientist/Plant Pathologist (Foundation Plant Services), UC Davis.

11:30am Transmission Biology of Leafroll Disease and its Mealybug Vector — Dr. Rodrigo Almeida, Assistant Professor (Environmental Science, Policy, & Management Dept.), UC Berkeley.

Lunch

1:00pm Biology and Control of Mealybug Populations in California — Dr. Kent M. Daane, Cooperative Extension Specialist (Environmental Science, Policy, & Management Dept.), UC Berkeley.

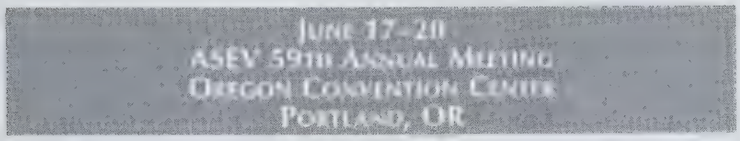
1:45pm Lessons learned from Managing LeafRoll Virus in New Zealand vineyards — Drs. J.T.S. Walker and Vaugn Bell, entomologists (Hawke's Bay Research Centre, HortResearch), New Zealand.

3:00pm Mapping and Spread of GLRAV-3 in New Zealand — Dr. Roderick Bonfiglioli, Technical Director (Linnaeus Laboratory, Riversun Nursery), New Zealand.

3:30pm Conventional and Molecular Strategies for Control of Leafroll Disease — Dr. Marc Fuchs, (Plant Pathology Dept.), Cornell University, NY.

4:30PM Wine social — Meet the Researchers.

To enroll, and for further details, see http://extension.ucdavis.edu/unit/winemaking/. Registration of $165 Section: 074VIT206 includes lunch and reception.



Tuesday, June 17
5th Joint Burgundy-California-Oregon Winemaking Symposium

A multi-regional discussion between winemakers and enologists/viticulturists to include a tasting. Organizers and moderators are: Christian Butzke, Pascal Durand (University of Bordeaux, France), James Kennedy (Oregon State University), Barney Watson (Chemeketa Community College, Oregon).

9:00AM Welcome/Review — **Christian Butzke**, Purdue University, IN.

9:15AM Winemakers — Oregon: **Harry Peterson-Nedry** (Chehalem Wines, OR), **Lynn Penner-Ash** (Penner-Ash Wine Cellars), OR.

10:00AM Wine Scientists — Oregon: **Greg Jones** (Southern Oregon University, Ashland, OR), **James Osborne**, Oregon State University, Corvallis, OR.

11:00AM Winemakers — California: **Josh Jensen** (Calera Wine Company), **TJ Rogers** (Clos de la Tech).

11:45AM Wine Scientist — California: **Hildegarde Heymann** (UC Davis).

12:15PM Lunch

1:30PM Wine Scientist — Burgundy

2:15PM Winemaker — Burgundy: **Roland Masse** (Hospices de Beaune, France)

3:15PM Roundtable discussion

Wednesday, June 18

8:00AM ASEV Classic Golf Tournament

ASEV schedule is subject to change without notice, for latest details, see http://asev.org/annual-meeting/daily-schedule/

Wednesday, June 18

8:30AM President's Welcome and the 2008 Honorary Research Lecturer, Professor Dr. Peter Winterhalter (Faculty of Chemistry and Pharmacy, Institute of Food Chemistry at the Technical University of Braunschweig), Germany, [whose research team focuses on natural product chemistry and aroma research] will present "Application of Countercurrent Chromatography in Wine Research and Wine Analysis."

10:00AM Disease — Moderator: Peter Cousins (U.S. Dept. of Agriculture, NY); Speakers: Andrew Walker (UC Davis) Using Marker-Assisted Selection to Breed for Pierce's disease Resistance in Grape; Wayne Wilcox (Cornell Univ., NY) Effects of Climate and Nitrogen Nutrition on Activation and Spread of Latent Botrytis Infections; Seiya Saito (Univ. of Yamanashi, Japan) Early Diagnosis of Fungicide-Resistant Botrytis cinerea in Vineyards by a Nested PCR-RFLP Method; Mark Krasnow (UC Davis) Clonal Propagation of the Berry Shrivel Disorder and Absence of a Cropload Effect.

10:00AM–5:30PM Supplier Showcase (Exhibits)

10:00AM–5:30PM Poster Presentations (Enology/ Viticulture poster authors present from 1:00–2:30PM, Enology Poster authors present 2:30–4:00PM).

10:20AM Aroma — Moderator: Susan Ebeler (UC Davis); Speakers: Michael Qian, (Oregon State Univ., Corvallis) Distribution of Free and Bound Monoterpene Alcohols and Norisoprenoids in Pinot Noir Grape Must and Skin; A.C. Silva Ferreira (Universidade Católica Portuguesa, Portugal) Identification of Key Odorants on Madeira Wine — Chemical Mechanisms Involved in Their Formation; Frank Benkwitz (Univ. of Auckland, New Zealand) Identification of Key Odorants in Sauvignon Blanc with Aroma Reconstitution and Omission Tests; Paul Kilmartin (Univ. of Auckland, New Zealand) Stability of Passion-Fruit Type Aromas in New Zealand Sauvignon Blanc wines.

1:00PM Vine Management — Moderator: Rhonda Smith (UC Coop. Extension, Sonoma County); Speakers: Imelda Ryona (Cornell Univ., NY) Impact of Light Exposure on IBMP Accumulation and Degradation during Berry Growth and Ripening; Sanliang Gu (Cal. State Univ. Fresno) Efficacy of ABA Application to Enhance Wine Color of Cabernet Sauvignon Grape in a Warmer Growing Region; Carmo Vasconcelos (HortResearch Marlborough, New Zealand) Effect of Trellis Type on Leaf Gas Exchange and the Dynamics of Storage Carbohydrates in Pinot Noir Grapevines.

1:20PM Wine Microbiology — Moderator: James Osborne (Oregon State Univ., Corvallis, OR); Speakers: Stuart Robinson (UC Davis) Identification of Genes Associated with Ester Formation and Degradation in Yeast Strain BY4742; Jeff Rowe (Oregon State Univ., Corvallis, OR) Kinetics of Yeast Protein Release during Aging of Wine on the Yeast Lees; Laura Weissberg (UC Davis) The Effect of Dissolved Oxygen Concentration on Brettanomyces Growth and 4-Ethylphenol Production; Eduardo Agosin (Pontificia Univ. Católica de Chile) Role of Wine Yeast Strains in Production of Positive Aroma Attributes during Winemaking.

2:20PM Berry Development — Moderator: James Harbertson (Washington State Univ.); Speakers: Mark Downey (Univ. of Adelaide, Australia) Variation in the Skin Tannin Content, Composition, and Polymer Length Distribution of 36 Different Grape Varieties; Gerard Logan (Eastern Inst. of Technology, New Zealand) Survey of Changes in Free Anthocyanin Accumulation at Different Vegetative Vigor Levels in *Vitis vinifera L.* Cabernet Sauvignon; Rachel Hanlin (Univ. of Adelaide, Australia) Tannin Accumulation and Composition During Grape Berry Development; Seth Cohen (Oregon State Univ.) — Assessing the Impact of Temperature on Development and Composition of Grape Berries (*Vitis vinifera L. cv.* Merlot); Julie Tarara (U.S. Dept. of Agriculture, Washington) Field Temperature and Anthocyanins in Merlot Grape Berries.

3:00PM Oxidation — Moderator: Roger Boulton (UC Davis); Speakers: John Danilewicz (United Kingdom) — The Interaction of Polyphenols, Oxygen and Sulfite in Wine; Dominik Durner (DLR Rhelnpfaiz, Germany) — Sensory and Chemical Changes Induced by Oxygenation during and after Fermentation in Pinot Noir and Cabernet Sauvignon wines.

4:00PM Pacific Northwest wine reception

Thursday, June 19

9:00AM Merit Award presentation

10:00AM–4:00PM Supplier Showcase (Exhibits)

10:00AM–4:00PM Poster Presentations (Viticulture and Industry poster authors present 2:30–4:00PM)

10:20AM Sensory — Moderator: Ann Colonna (Oregon State Univ., Portland); Speakers: Amy Bowen (Brock Univ., Canada) The Influence of Harvest Date on the Sensory Profiles of Icewines from the Niagara Peninsula; Maurizio Ugliano (Australian Wine Research Institute, Australia) Modulation of Shiraz Volatiles, Color and Aroma Aging Potential through Di-Ammonium Phosphate Addition; Ulrich Fischer (DLR Rheinpfalz, Germany) Sensory and Chemical Changes Induced

Continued on page 103

Beverage Supply Group

Beverage Supply Group (BSG) is a division of Brewers Supply Group, a well-established company delivering products and technical support services to the brewing industry for over 150 years. Strategically located across the U.S., BSG is pleased to offer proven products to the wine industry with the same dedication to service and support that has won the allegiance of our brewing counterparts.

Beverage Supply Group

Known for an outstanding range of yeast and MLF nutrients, BSG offers in-depth assistance with all aspects of fermentation nutrition. **Superfood®**, the gold standard of nutrient blends, plus all other unique supplement blends developed by Lisa Van de Water (Vitamix®, Supervit®, Leucofood™ etc.) come with personalized technical support.

A new line of very promising **Vintagezym** enzymes from Kerry, was introduced in the 2007 harvest. The results of color stabilization, increased mouthfeel, aroma enhancement, and the softening of harsh tannins, are exceptional with several of these products. Trial samples are available.

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Most products and technical support information are available online at www.BSGwine.com.

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Beverage Supply Group
PO Box 10649, Napa, CA 94581
tel: 800/585-5562
e-mail: sbrent@rahr.com
website: www.bsgwine.com

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Barrel Builders, Inc.

Add-in products have become a staple of winemaking, and are an adaptable and cost-effective alternative to traditional barrel flavor extraction. They are particularly useful when they can add complexity at an affordable cost.

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PO Box 268, St. Helena, CA 94574
tel: 800/365-8231; fax: 707/942-5426
e-mail: heather@barrelbuilders.com
website: www.barrelbuilders.com

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Begerow USA, Inc.

Begerow GmbH & Co. is a competent supplier for liquid filtration. Years of experience, technical expertise, and a global network of subsidiary and partner companies make Begerow a leading manufacturer in this field, with particular focus on the food and beverage industries.

Begerow offers a variety of high-quality products for wine, fruit juice, and spirit production, ranging from yeast products to complete, fully-automatic filtration systems. Enological products, such as a variety of pure yeast solutions for wine processing, play an important role in Begerow's wide product range.

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The company places great importance on providing cooperative service and competent advice, down to the last detail.

As the only single-source provider, Begerow offers innovative, customer-oriented, high-quality systems. Begerow regularly undergoes audits by external specialists and independent institutes in order to continuously improve quality standards. Begerow stands for safety and reliability, and can guarantee top quality to customers.

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For more information, contact:
Begerow USA Inc.
Bob Spadafora
tel: 703/673-1160
e-mail: bob.spadafora@begerow.com
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Enartis

Enartis is a division of the Esseco Group, an Italian company that has been assisting winemakers around the globe for the past 80 years.

While relatively new in the U.S. market, Enartis has broad international expertise and a staff of passionate professionals, dedicated to providing winemakers the products and technical support needed to address all winemaking needs.

Products include yeasts and nutrients, enzymes, polysaccharides, fining/clarifying agents, tannins, gum and stabilizers, sulfur derivatives.

The company's *vision* is creating value in enology through research, development, and production of targeted, innovative, and safe solutions. Enartis' style is based on scientific knowledge at the service of nature, technology aimed at preserving the quality of grapes, cooperation with the customer in the development of specific protocols, and a complete range of winemaking materials; integrated with state-of-the-art application solutions.

Enartis offers a complete range of the finest winemaking products that find their application from the moment the grapes are picked in the field to the final stages of fining and bottling.

For more information, contact:
Enartis
Susan Johnson
1644 Olivet Road, Santa Rosa, CA 95401
tel: 707/542-2719; fax: 707/542-2719
e-mail: susan.johnson@enartis.com
website: www.enartis.com

PLEASE SEE ENARTIS AD, PAGE 58.

Pacific Winemaking

Pacific Winemaking (PW) was established to link quality suppliers of innovative winemaking products with premium winemakers to enhance quality, efficiency, and winemaking returns. PW focuses on supplying Oregon, Washington, Idaho, and British Columbia.

PW represents the Vason Group, whose extensive R&D facility and years of experience in the European wine market integrates both applied biotechnology with innovative engineering. Vason supplies quality yeasts, nutrients, malolactic bacteria, high purity enzymes, fining agents, and tannins.

Ju.Cla.S. Beverage Systems, a division of Vason, are manufacturers of engineered solutions. Ju.Cla.S. products include precise micro-oxygenation, micro-filtration, spiral wound membrane cross flow technology, filterability testing, automated yeast hydration, flotation systems, and reverse osmosis.

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ONDINE CHATTAN

A busy woman. Chattan is Director of Winemaking at Geyser Peak Winery in Geyserville, CA, overseeing production of 330,000 cases annually, working with 225 acres of estate vineyards in Alexander Valley. She also is Winemaker for XYZin Wines.

A loyal reader. Chattan has been reading PWV for 12 years.

Why she reads PWV:
"For me, PWV is a must-read and frequent companion. The magazine provides up-to-date, progressive information about real winery and vineyard issues with an inquiring eye to the future. The no-nonsense approach, expert contributors, practical application, and varied approaches (from researchers to laymen) to subject matter, make it both reliable and exciting to read. The format often includes helpful diagrams and schematics to clarify subject matter, and the tone assumes an industry insider's level of knowledge to tackle the bigger issues. The voice of the magazine is informed and enthusiastic in pursuit of knowledge and improved wine quality."

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Human health concerns associated with wine microorganisms

When thinking about wine and the microbes that can thrive in its acidic and alcoholic environment, most industry personnel correctly focus their attention on the impact of wine microbes on the quality and style of their respective wines. However, gradually over the past 15 to 20 years, it has become evident that certain wine microorganisms can also pose a risk to public health by producing chemicals that can impact the hygienic quality of wine at various stages in the winemaking process.

From a winemaking perspective, there are two types of compounds produced by wine microbes that have health implications for the consumer: biogenic amines and ethyl carbamate. Biogenic amines have been shown to cause negative physiological effects in allergic humans (such as headaches, nausea, hot flashes), while ethyl carbamate is considered to be a probable carcinogen to humans. The probable carcinogenic properties of ethyl carbamate are based on studies with experimental animals; there is no direct evidence of it causing cancer in humans.

This column provides an overview of biogenic amines and ethyl carbamate: background, wine microbes involved, mechanism of formation, factors that affect formation, toxicity, legal/maximum limits, and recommendations for prevention.

Background

Biogenic amines are low-molecular-weight, nitrogen-containing compounds that are formed in wines primarily by microbial (yeast and lactic acid bacteria) decarboxylation of precursor amino acids. They have been detected in grapes with spermidine and putrescine being the most abundant. During the winemaking process, the main biogenic amines are histamine, tyramine, putrescine, cadaverine, and phenylethylamine.[1,2,3,4,5]

The concentration and type of biogenic amines vary greatly in wines; however, generally red wines contain significantly more than white wines. In addition, there appears to be a direct correlation between elevated biogenic amines in wine, wine spoilage constituents (such as acetic acid, ethyl acetate, butyric acid, acetoin, and higher alcohol compounds), and malolactic fermentation.[4,6]

Ethyl carbamate, which is also called urethane, can be formed in wine from the spontaneous reaction of ethanol with urea, citrulline, or carbamyl phosphate. Wine yeast produce urea and to a lesser extent citrulline, while certain lactic acid bacteria produce citrulline and carbamyl phosphate. Ethyl carbamate formation has been shown to occur in various alcoholic beverages (ciders, beer, wine, and sake) and fermented foods (bread, soy sauce, and yogurt).[7,8]

Because ethyl carbamate is a probable carcinogen, it is becoming the focus of international regulation, and so its formation must be managed properly both in the vineyard and during the winemaking process.

Wine microbes involved in formation

Both yeast and bacteria can form biogenic amines during the winemaking process; however, controversy still exists over whether yeast or bacteria are the primary producers. Many different yeast genera can form amines, including *Saccharomyces, Brettanomyces, Kloeckera, Metschnikowia,* and *Candida. Brettanomyces bruxellensis* has been shown to cause the highest level of formation, followed by *Saccharomyces cerevisiae.*[9]

In addition, depending on the *Saccharomyces cerevisiae* strain used for alcoholic fermentation, the level of biogenic amine formation can vary.[10] Among wine bacteria, both indigenous and commercial strains of several lactic acid bacteria genera can form biogenic amines: *Lactobacillus, Pediococcus,* and *Oenococcus.*[4,5]

However, not all strains within each species of lactic acid bacteria can form biogenic amines.[5,11] The main producers of biogenic amines among the lactic acid bacteria are *Pediococcus,*[12] *Oenococcus oeni,*[13] *Lactobacillus brevis,* and *Lactobacillus hilgardii.*[14]

Wine yeast and bacteria can produce the precursors necessary for the formation of ethyl carbamate. Amongst the yeast, strains of *Saccharomyces cerevisae* can vary in their ability to produce the ethyl carbamate precursor: urea.

For the wine bacteria, only the heterofermentative lactic acid bacteria (such as *Oenococcus oeni, Lactobacillus hilgardii, Lactobacillus brevis,* and *Lactobacillus buchneri*) can produce the necessary precursors for ethyl carbamate formation. Heterofermentative bacteria ferment sugar to lactic acid, carbon dioxide, and significant amounts of either acetic acid or ethanol.

The homofermentative lactic acid bacteria (such as *Lactobacillus plantarum, Lactobacillus delbrueckii,* and *Pediococcus sp.*) do not have this ability.[15,16,17] They metabolize sugar to lactic acid and minimal levels of acetic acid and carbon dioxide.

Mechanism of formation

Both yeast and lactic acid bacteria produce biogenic amines from amino acids (histidine, tyrosine, etc.) with specific amino acid decarboxylase enzymes. In this enzymatic reaction, the carboxylic acid group on amino acids is replaced with hydrogen yielding the corresponding amine. Amino acids are present in grapes, must, and wine, so it is important that factors influencing their conversion to amines are minimized as much as possible.

The mechanism for ethyl carbamate precursor formation is different for yeast and bacteria. Yeast have an arginase enzyme that catabolizes the amino acid arginine into ornithine, ammonia, and carbon dioxide.[18] An intermediate product of this reaction is urea, which can be secreted into wine under certain conditions (increased fermentation temperature). Upon secretion, urea spontaneously reacts with ethanol to form ethyl carbamate.

The lactic acid bacteria lack arginase activity, so they use the arginine deiminase (ADI) enzymatic pathway to degrade arginine into precursors for ethyl carbamate formation.[19] The ADI pathway produces two intermediates, citrulline and carbamyl phosphate, which can spontaneously react with ethanol to form

ethyl carbamate. Even though both yeast and bacteria can generate precursors for ethyl carbamate formation, urea produced from wine yeast is thought to be the major precursor.[20]

Factors that affect formation

Throughout the winemaking process, a whole host of factors can influence the formation of biogenic amines including:
1) initial microbial populations present on grapes;
2) presence of precursor amino acids in grape juice;
3) ageing of wine on either yeast lees (*sur lie* ageing) or lees following malolactic fermentation;
4) extended grape maceration;
5) spontaneous malolactic fermentation by indigenous lactic acid bacteria;
6) number of lactic acid bacteria that are decarboxylase-positive;
7) wine pH;
8) concentration of sulfur dioxide (SO_2) following malolactic fermentation and during ageing;
9) winery sanitation practices;
10) yeast strain; and
11) fining practices (fining white wines with bentonite may remove biogenic amines).

Among these factors, it has been demonstrated that malolactic fermentation is the primary stage for biogenic amine formation during the winemaking process.[21]

Ethyl carbamate formation is affected by the following factors:
1) arginine content of grapes;
2) concentration of ethanol;
3) nutrient additions to must, during both alcoholic and malolactic fermentations;
4) yeast strain;
5) spontaneous malolactic fermentation by indigenous lactic acid bacteria;
6) ageing wine on yeast lees (*sur lie* ageing);
7) temperature of wine during ageing and shipment;
8) duration of wine ageing;
9) wine pH; and
10) winery sanitation practices.

Toxicity

Several biogenic amines have been shown to cause allergic reactions in sensitive humans. The most researched biogenic amine, histamine, is known to cause headaches, heart palpitations, low blood pressure, facial flushing, edema, thirst, sore throat, rashes, vomiting, and diarrhea.

Tyramine and phenylethylamine have been shown to cause hypertension and migraines.[4] The presence of ethanol and acetaldehyde is thought to increase the toxicity of these amines.

Due to the multitude of variables involved, it is difficult to define an exact toxic threshold for biogenic amines; however, studies have shown that approximately 3 mg/L, 25 to 40 mg/L, and 20 mg/L respectively of phenylethylamine, tyramine, and histamine can elicit physiological effects. Wine

Table 1: Recommendations to prevent formation of biogenic amines and ethyl carbamate

Biogenic Amines	Ethyl Carbamate
If possible, periodically monitor microbial populations on grapes to determine risk for biogenic amine producers.	Avoid arginine content of >1000 mg/L in juice.
If possible, assess concentration of primary precursor amino acids in grapes and must.	Avoid excessive nitrogen fertilization of vineyards.
Avoid spontaneous alcoholic fermentations and use commercial strains of *Saccharomyces cerevisiae* that lack or have minimal decarboxylase activity.	Periodically monitor nitrogen status of vines and soil.
Avoid extended ageing of wine on yeast or malolactic lees.	Test nitrogen status of juice.
Try to minimize extended grape maceration.	Avoid adding excessive nitrogen supplements; do not add urea.
Avoid spontaneous malolactic fermentations and use commercial strains of *Oenococcus oeni* that lack or have minimal amino acid decarboxylase activity.	Use commercial strains of *Saccharomyces cerevisiae* that are known to produce low levels of urea (Premier Cuvee® (PdM) or Lallemand 71B®) when juice has a high arginine content.
Try to avoid higher pH wines (above 3.7) since they allow proliferation of *Lactobacillus* and *Pediococcus*.	Avoid ageing wine on yeast lees (*sur lie* ageing), which can liberate amino acids and proteins.
When pH of wine is high, lysozyme can be added to remove the natural lactic acid bacteria.	Avoid spontaneous malolactic fermentations and use commercial strains of *Oenococcus oeni* that do not have ability to produce high levels of citrulline.
Immediately following malolactic fermentation and during wine ageing, maintain molecular SO_2 levels of at least 0.4 to 0.5 ppm to prevent or minimize growth of lactic acid bacteria.	Avoid elevated temperatures during ageing and shipment of wine.
Maintain good sanitation practices during wine production.	If wines are going to be aged for an extended period of time, it is advisable to periodically monitor ethyl carbamate levels.
	Try to avoid higher pH wines (above 3.7) since they allow proliferation of *Lactobacillus* and *Pediococcus*.
	Immediately following malolactic fermentation and during wine ageing, maintain molecular SO_2 levels of at least 0.4 to 0.5 ppm to prevent or minimize growth of lactic acid bacteria.
	Maintain good sanitation practices during wine production.

contains on average 1.7 mg/L of phenyethylamine, 7.6 mg/L of tyramine, and 4.15 mg/L of histamine.[4]

In 2007, the World Health Organization elevated the classification of ethyl carbamate to a Group 2A carcinogen, which means that it is probably carcinogenic to humans. It was previously classified as a Group 2B carcinogen (possibly carcinogenic to humans). Other Group 2A carcinogens include arsenic, anabolic steroids, acrylamide, diesel exhaust, and mustard gas.

Even though there have been no adequate studies in humans, animal studies have demonstrated that ethyl carbamate will cause cancer when injected, administered orally, or applied to skin.

Legal limits / Maximum limits

Currently, there are no legal limits in place for biogenic amines, but several European countries have established recommended maximal levels for histamine on imported wines: Germany (2 mg/L); The Netherlands (3 mg/L); Belgium (5 to 6 mg/L); France (8 mg/L); Austria (10 mg/L); and Switzerland (10 mg/L).[22]

Currently, the U.S. does not regulate biogenic amine content in wines, but it does for fish, so it is likely only a matter of time before a regulation is instituted.

Ethyl carbamate is subject to international regulation, and the U.S. wine industry has established a maximal target level of 15 μg/L (ppb) for table wines and less than 60 μg/L (ppb) for dessert wines. All countries exporting wine to the U.S. have been notified that they must be below these maximal levels.

Recommendations for prevention

Table I shows the recommended preventive actions that can be employed from the vineyard to finished wine product to minimize or even prevent formation of biogenic amines and ethyl carbamate in wine products. See C. Butzke and L. Bisson for an excellent overview of recommendations to minimize ethyl carbamate in wine.[23]

Conclusions

Because possible serious human health implications are associated with biogenic amines and ethyl carbamate, it is clear that the content of both organic molecules will be increasingly scrutinized in wine products and thus will likely become more strictly regulated by governments around the world.

As the regulations tighten, the presence of levels of biogenic amines and ethyl carbamate in wines above the regulated limit in their wines will become an export barrier for wineries. To stay ahead of the regulations, it is advisable that wineries begin to routinely monitor their wines for both compounds and take steps to manage or even prevent their formation. ■

Dr. Robert Tracy, with nine years of scientific research experience and seven years of winery laboratory and quality control/quality assurance experience, specializes in wine chemistry and microbiology, winery sanitation, and QA/QC. He is co-founder of BevTrac Mobile Quality Systems LLC, based in Windsor, CA (www.bevtracquality.com), providing a mobile wine laboratory and consulting services to the wine industry. Please direct inquiries to robert.tracy@bevtracquality.com or tel: 707/239-8581.

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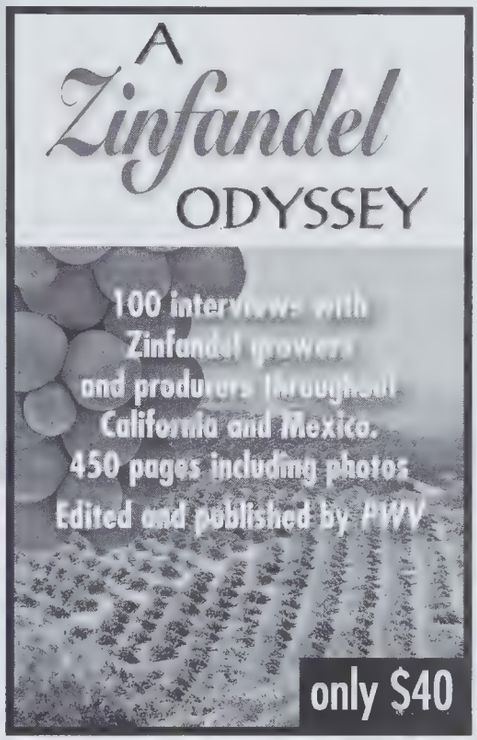

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SMART VITICULTURE *by Dr. Richard Smart*

Vines, wines, and more heat...

In February, I attended the second International Climate Change and Wine Conference in Barcelona, Spain, organized by the Wine Academy of Spain. It attracted 350 people from 36 countries. The first conference was held exactly two years ago and only 75 people attended.

The change in attendance at the conference is an indication of growing awareness by the world wine sector of the significance of this issue. As further example of this, one sponsor of the conference was the OIV (the international office of vines and wine). The two-day conference involved speakers from several countries, including Australia, France, England, Germany, Spain, and the U.S. One disappointing feature of the conference was that many of the wine-producing regions in Europe were not represented in the audience.

The program included speakers with a wide range of expertise. Bernard Seguin, a climate scientist from France, emphasized the reasons for climate change and the likely implications for the global climate. I spoke on the impact of climate change on vines and viticulture, and Greg Jones of Oregon and Hans Schultz of Germany spoke of further implications of climate change on global wine production. There were several speakers from the contemporary French industry, including Bruno Prats, Michel Rolland, Jacques Lurton, and Pascal Chatonnet.

Carbon footprint of the wine sector

Pancho Campo (director of the Wine Academy of Spain) provided an analysis of the carbon footprint of the wine sector. Campo estimated that wine industry emissions are less than 0.1% of those of all world sources. He showed that, in general, while vineyards are able to sequester CO_2, considerable CO_2 is released at fermentation. For example, one liter of juice at 22° Brix releases 107 grams of CO_2 during fermentation.

Campo claimed that the largest contribution the wine sector makes to global CO_2 emissions is in transport. Obviously, this is lower for container ship transport than for rail and road and especially air transport. For example, the carbon footprint of sending wine from Australia to Chicago using a combination of rail and sea transport is less than sending wine from Napa to Chicago using over night air express in heavy bottles.

Several speakers addressed wine packaging. Packaging makes up about half the volume and weight of a case of wine, a very high ratio compared to most of the goods we buy. This inefficiency is, of course, largely due to glass bottles and their shape. Glass has been used as a wine container since the 17th century in Europe. Perhaps it is time to review the standard, since the carbon footprint of transport is so high! Tetra packs are far more efficient, being lighter and of more convenient shape than bottles.

Climate change is already happening

Perhaps some members of the audience came to the conference thinking that climate change is an issue of the future. Surely they left with their minds changed, as the climate certainly has changed already! Considerable data was presented, confirming that warming has occurred over the last several decades with pronounced effects on viticulture and wines.

Greg Jones (Southern Oregon University) presented the results of his survey examining the climate reports on 27 wine regions of the world from 1950 to 2000. These regions showed an average-warming of 1.3°C over 50 years of growing seasons, and an average warming of 1.4°C over the dormant seasons.

Of significance was an increase in temperature variability noted in 18 of the 27 regions. Jones found that there was more effect on the minimum rather than maximum temperatures, and there were substantial changes in the date of the last spring frost and the first fall frosts, resulting in an average increase in frost-free period of between 13 and 41 days, depending on the region.

Results in the western U.S. were comparable to other places in the world. There was an increase in growing season temperatures of 1.4°C and a longer frost-free period, from 18 to 65 days, depending on the location. Phenology trends, such as earlier bloom and harvest, were six to 20 days earlier over numerous varieties and locations.

One of the clearest examples of increased temperature is its effect on harvest, particularly in cooler grapevine regions. For example, Seguin spoke of the change in harvest date in Bordeaux, which has come forward almost one month, from early October to early September. In the heat wave year of 2003, the temperature conditions in Bordeaux were like those of Montpellier at the base of the Rhône Valley.

Michel Rolland, noted wine consultant of Bordeaux, stated that, in his opinion, global warming could not be considered to be negative in Bordeaux. In the 1970s, the primary problem facing Bordeaux vintners was to achieve ripe fruit. Must amelioration with sugar was common. However, in the last 10 years, it has not been necessary to add sugar, and the wines show better phenolic character from properly ripened fruit.

Bruno Prats of Bordeaux echoed these sentiments. Prats says his son, who has taken over Chateau Cos D'Estournel, has more luck than he had with the fruit available for wine-making. Chaptalization (sugar addition) was common in the 1970s in almost every year, yet by the 1990s, it was used about every second year. In the last decade, chaptalization has not been used at all.

However, a note of caution should be added. Which are the traditional wine styles of Bordeaux? Are they those of 100 years ago, of 30 years ago, or of the present? What will they be 30 years in the future? These are questions I asked, and I introduced the term "post-classic wines" to indicate that, perhaps for some regions, we have already seen the best wines produced from the varieties that made the region famous. In the future, these wines will not be produced so frequently.

Some countries will be lucky...

Not all the news about climate change is bad. There are several countries where present production has been limited by cold temperature. England is such an example. Its wine industry has grown from 80 hectares in 1974 to 1,300 hectares in 2007. This growth has occurred in response to increase in temperature; 2006 was England's warmest year in 350 years and 2007 the second warmest.

England has a large wine market, the second-largest market for champagne, and 20 million people within 150 km of the present wine regions. English wines are currently winning international medals in sparkling wine classes.

Similarly, there is increasing interest in wine production in Denmark and Holland, and wine production is changing in Germany. Over 25 years, some vintners have seen the change from adding water and sugar to now adding acid. Long-term experiments have shown that yield has not changed, but sugar levels have increased and acidity has fallen. Of particular concern are the steep slope vineyards in Germany, which will be more prone to erosion with global warming's projected high-intensity rainfall events.

Most wine producing countries will not be so lucky...

An important part of the message about climate change response is adaptation. Most speakers agreed that it is not realistic, in general, to contemplate moving to new vineyard areas. This applies particularly for the well-known and traditional wine areas with their extensive infrastructure.

Present regions that are cool or warm have the opportunity to change varieties to those better suited to the future, warmer climates. However, the outlook is not so rosy for the already-hotter areas, such as parts of Spain, the central valley of California, and the inland regions of Australia. Experience tells us that the production of winegrapes is not so well-suited to very hot climates, and that vineyards in these areas are better suited to table grapes and raisins or other crops.

In my presentation to the conference, I urged an international effort for the conventional breeding of grape varieties better suited to hot climates. Although some speakers mentioned the opportunities of genetic modification, I am not nearly so optimistic about this approach.

I suggested to the audience that some enthusiastic "gene jockey" might take a gene from (heat-tolerant) cactus and put it in Chardonnay, to produce a heat-tolerant Chardonnay. Or, how about Chardonnay-flavored Tequilla as an alternate outcome?

The last two or three decades have demonstrated just how successfully conventional grapevine breeding can produce new varieties adapted to cool climates, as has been the case for German research institutions. I am confident that with selection of appropriate germplasm, we can also produce varieties better suited to hot conditions of the future.

Prats, however, warned of other implications of climate change. Previously the best vintage years in Bordeaux were dry, but perhaps in the future they will become too dry and water supplies to vines will become critical. Prats did remain optimistic about the future of Bordeaux, because of the opportunity to change to varieties more suited to future conditions.

For example, the present minor variety Petit Verdot has a great potential in hotter climates. Other old Bordeaux varieties may be reintroduced into the mix, including Carmeniere, a late season red variety that disappeared after phylloxera hit Bordeaux, though it may yet return to its region of origin. Malbec is in a similar position.

One particular concern in Europe is the lack of irrigation infrastructure, should irrigation eventually be needed. Jacques Lurton is a Bordeaux winemaker who has winemaking interests in South Australia. He says that an essential element of vineyard site selection in Australia is security of water supplies for irrigation, yet this has never been a criterion for vineyard location in Europe. He says that finding sufficient water for irrigation may be a problem in many traditional areas of Europe.

Of the present wine-producing countries, those of the southern hemisphere are more fortunate than those of the north. This is because the temperature rises are projected to be smaller in the southern hemisphere, due to the greater proportion of ocean there.

Parts of Australia (especially Tasmania), New Zealand, Chile, and Argentina will experience the least impact from climate change. Chile is particularly fortunate, as it has very cold ocean currents at the coast. Therefore, in terms of planting vineyards, there are opportunities to go to the west into cooler coastal valleys, to the east and plant cooler, elevated foothills of the Andes mountains, or further south to Patagonia

Greg Jones studied projected changes in temperature and implications for the western U.S. The availability for winegrape production in California will shrink and the areas available in Oregon and Washington will increase,

Conclusion

The conference raised several issues that are pertinent for the future of the world wine sector. It seems to me that most people in the wine business are addressing this issue by considering their carbon footprint, perhaps rather than considering the larger issues. The solution to climate change will come from a global approach, as was successful in reducing CFC emissions and hence the ozone hole.

Former U.S. Vice President Al Gore spoke to the conference by satellite and emphasized that, while the wine industry is to be congratulated for its preemptive action, the eventual solution to the global dilemma is a political one. Gore emphasized that he believes the technological solutions to the problem are available or soon will be.

The U.S. wine sector was not particularly well-represented at the conference, though invitations were sent. Nor is the U.S. a member of the OIV. (The U.S. is the world's greatest emitter of CO_2). Does this say something about the level of awareness of this issue in the U.S. wine sector, and its ability to contribute to global wine concerns?

I wonder how many of readers have considered the future of their interests in the wine business, in 20 or 30 years time? How will your wine-industry business be

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COMPLIANCE COUNSELING *by Rachel Dumas Rey*

Self-distribution for wineries

Before May 2005, when the U.S. Supreme Court published its decision on *Granholm v. Heald*, both New York and Michigan allowed in-state wineries to ship wine directly to consumers, but prohibited out-of-state wineries from doing so. The Supreme Court ruled that such a prohibition violated the 21st Amendment.

Since that decision was issued, there has been a significant increase in the number of states that allow direct-to-consumer sales from out-of-state wineries. Today, according to the California Wine Institute, 35 states allow sales to consumers allowing wineries access to about 80% of the U.S. population of legal drinking age.

What is self-distribution?

The Granholm decision and subsequent litigation around the U.S. (such as *Costco Wholesale Corp v. Hoen*), have made it illegal in many states to provide an unfair advantage to in-state wineries with regard to sales to restaurants and retailers.

Until 2007, wineries that wanted to place their wines in out-of-state restaurants, grocery stores, or wine retail stores had to sell to a wholesaler in that state, who would then sell to the restaurants or retailers. Today, several states allow wineries to act as their own wholesaler under certain conditions. Here is a link for the state-by-state summary of self-distribution compliance requirements:

http://www.compli-beverage.com/oos/ds/

In an attempt to secure their position in the three-tier distribution system, wholesalers around the U.S. are trying to block self-distribution. But the Supreme Court notes in the *Granholm* decision that "State policies are protected under the 21st Amendment when they treat liquor produced out-of-state the same as its domestic equivalent. The in-state cases, in contrast, involve straightforward attempts to discriminate in favor of local producers. The discrimination is contrary to the Commerce Clause and is not saved by the 21st Amendment."

The Commerce Clause prohibits states from passing laws that improperly burden or discriminate against interstate commerce. Thus, in states where self-distribution is permitted for in-state wineries but prohibited for those outside the state, legislators have two options: they must either open the state to self-distribution from outside the state or disallow that privilege for in-state producers.

One result of this conflict is that wholesaler associations (in hopes of presenting a united front to legislative bodies) are negotiating with wineries to allow self-distribution, but with a production cap. The cap is large enough to allow most small in-state producers to self-distribute, but small enough to exclude larger producers in California, Oregon, and Washington.

The Losers

There are winners and losers in this contest for control of wine sales. Losers are the wineries in states where self-distribution has recently been outlawed, including Louisiana, Mississippi, Delaware, Kentucky, and Virginia. 160 wineries in Virginia enjoyed self-distribution in their home state until 2005, when the U.S. Court of Appeals for the Fourth Circuit ruled that self-distribution by Virginia wineries was unconstitutional.

In *Wine East* magazine (May/June 2007), Terri Cofer Beirne wrote, "The court's reasoning was consistent with the *Granholm* decision by the U.S. Supreme Court that was soon to come; namely, that a state cannot create a scheme that benefits the in-state industry while burdening the out-of-state industry. Self-distribution by only Virginia wineries, the Fourth Circuit ruled, created an economic benefit for the in-state industry in the form of lower prices. No mandatory use of independent wine wholesalers reduced mark-up, costs, and prices."

Since then, small wineries in Virginia have lost significant business because they have lost access to their customers and wholesalers are unwilling to distribute their wines. However, when this column was written (March-2008), Virginia wineries could see some light at the end of the tunnel.

The Virginia Department of Agriculture has established a nonprofit company called the Virginia Winery Distribution Company (VWDC) that, in essence, will allow wineries to self-distribute under its auspices. To get their wines into restaurants and retailers, participating wineries must act as an agent of the VWDC and share their employees, some physical space, and their delivery vehicles with the VWDC. It is not a simple solution, but it allows the state to prohibit self-distribution by out-of-state wineries while allowing it for in-state wineries.

The Winners

Winners in this situation are the small wineries in states where the wine industry plays a major role in the economy. California, Oregon, and Washington are home to hundreds of small wineries that, in most cases, will not exceed the production caps that are being imposed in other states with self-distribution privileges.

What the future holds

We will continue to see states coming down on both sides of the self-distribution issue. In regions where the wine industry is strong, there may be some contentious battles, like the one in Virginia. New York currently allows self-distribution for in-state wineries, but the powerful wholesalers in that state will challenge any move to extend the privilege to out-of -state wineries. Because Granholm did not specifically address self-distribution in New York, the state legislature has not been forced to pass laws allowing it.

Other large markets for wine, such as Florida and Texas, have fewer wineries and are home to major wholesale players — self-distribution will probably not be allowed in those states.

Washington and Oregon provide the models for self-distribution legislation: there are no capacity caps and no

volume limits. The strength of the wine industry in this part of the U.S. has resulted in liberal laws for direct-to-retail sales. Currently, California does not allow self-distribution for out-of-state wineries. Self-distribution privileges may be extended to those wineries rather than the prohibition of direct-to-retail sales for wineries in California.

Conclusion

We are a long way from dismantling the government-mandated three-tier system of distribution for alcoholic beverages although that is the goal for many in the wine industry. Meanwhile, the changes in both direct-to-retail and direct-to-consumer laws around the country are allowing wineries greater access to their customers. The playing field is slowly leveling out. ■

Rachel Dumas Rey is president of Compli, a full service beverage compliance firm in Paso Robles, CA. Prior to establishing Compli in 1997, she worked for the U.S. Department of Commerce's Export Administration in Washington D.C.

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by Secondary Fermentation of Riesling and Chardonnay Sparkling Wines; Gregory Hirson (UC Davis) Chemical and Sensory Effects of Wine Glass Shape; C.M. Lucy Joseph (UC Davis) Human Differences in Detection of Brettanomyces Odor Impact Compounds.

10:20AM Water Relations, Part I — Moderator: Nick Dokoozlian (E&J Gallo Winery, CA); Speakers: Eve-Lyn Hinckley (Stanford Univ., CA) From Fumigant to Tracer: How Sulfur Inputs Provide Insight into Vineyard Water Losses; David Sorokowsky (RH Phillips Vineyards, CA) Evapotranspiration-based Irrigation Scheduling for Syrah in California — Assessing Vine Water Status by Petiole Electrical Potential; Albert Strever (Stellenbosch Univ., South Africa) A Study of Vine Pigment Reaction to Water Stress with the Incorporation of Conventional and Hyperspectral Measurement Techniques; Larry Williams (UC Davis) Relationship between Grapevine Water Use and Dry Biomass Production and Nitrogen and Potassium Uptake; Dan Rodrigues (Cal Polytechnic State Univ., San Luis Obispo) — Influence of Irrigation Strategies on Photosyntheitc Rates of Syrah Grape Vines.

1:40PM Water Relations, Part II — Speakers: William Drayton (UC Davis) The Role of Embolism in the Drought Response of Grapevines; Sara Spayd (North Carolina State Univ., Raleigh, NC) Influence of Regulated Deficit Irrigation and Crop Level Management on Soil and Vine Water Status and Vegetative and Reproductive Growth/ Fruit Composition and Wine Sensory Characteristics; Jim Willwerth (Brock Univ., Canada) Impact of Vine Water Status on the Sensory Profile of Riesling Wines.

1:40PM Phenolics — Speakers: Gerard Logan (Eastern Inst. of Technology, New Zealand) Impact of Vine Vigor on Berry Parameters and Free Anthocyanin Extraction in Hawkes Bay *Vitis vinifera* L. Syrah; Tiago Sampaio (Oregon State Univ., Corvallis) Berry Deformability, Fruit Phenolic Composition and Extraction into Wine; James Kennedy (Oregon State Univ., Corvallis) Effect of Berry Crushing on Skin and Seed Tannin Extraction During Fermentation and Maceration; James Harbertson (Washington State Univ., Prosser, WA) The Effect of Saignée and Extended Maceration on Wine Phenolic Composition; Wynne Peterson-Nedry (UC Davis) Tannin Partitioning into Extractable and Bound Fractions during Commercial Pinot Noir Fermentations; Sarah Forester (UC Davis) Identification and Toxicity of Microfloral Anthocyanin Metabolites.

FRIDAY, JUNE 20
[9:00AM–5:00PM]

Sensory Symposium: From the Vineyard to Consumer Preference (includes tasting) — Co-organizers: Ulrich Fischer (Dienstleistungszentrum Ländlicher Raum (DLR), Germany), Hildegarde Heymann (UC Davis).

The understanding of viticultural principles, reaction of the vine to climatic and soil conditions, and the ripening process of the grape have increased tremendously over the last two decades. Much of the knowledge gained is based on analytical chemical and physical information, measuring physiological parameters in the vine and constituents in the grapes and wines. However, wine is sold to consumers, rather than its constituents. Quality is only perceived based on interaction between wine constituents and human receptors through brain processing.

Sensory science serves as the most relevant tool to bridge the gap between wine constituents and human perception. Sensory methods allow us to interpret development and differences in wine constituents such as aroma compounds or tannins. These constituents stimulate color, aroma, or taste perception by all who taste wine, including wine consumers, wine critics, and the entire winemaking community. In contrast to informal wine tasting, sensory science relies on replicated assessment by a group of trained judges. As a result, extreme individual opinions disappear in the objective average.

To tackle a central question of grapegrowing and winemaking, "How can I make a better wine?" it is essential to apply well-established sensory methods. Presentations will address:

- the impact of different geological formations on the sensory profile of Riesling wines in the vineyard,
- newest findings in flavor research from a sensory perspective,
- which sensory properties of our wines stimulate consumer preferences and which may be contra-productive,
- qualitative interpretations by food industry professionals who are responsible for wine production, the decision of which wine is listed in retail, and what quality ratings wines receive in publications,
- how to enhance the preferred and avoid the undesirable sensory attributes during the winemaking process,
- modern research on the brain, which shows that sensory perception and qualitative interpretation occurs in separate areas of the brain and that a taster's expertise is reflected by different brain activities during wine drinking.

Speakers include: Hildegarde Heymann [Moderator], UC Davis; Andrea Bauer (Dienstleistungszentrum Ländlicher Raum [DLR], Germany); Vincente Ferreira (Univ. of Zaragoza, Spain); Leigh Francis (Australian Wine Research Institute); Ulrich Fischer (Dienstleistungszentrum Ländlicher Raum [DLR], Germany); Georges Giraud (Clermont-Ferrand, France); Jennifer Jo Wiseman (E & J Gallo, California).

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PERSONNEL POINT OF VIEW *by Anne Heron*

Successful talent acquisition

To build a team of the best and brightest, many wineries find that it pays to move beyond hiring employees to investing in activities that result in "talent acquisition." What's the difference? Elements of the process may look the same, but the results will be dramatically different.

According to the dictionary, "to hire" means "to obtain the services of a person by giving them a job," while "to acquire" means "to gain, usually by one's own exertions; to get as one's own; to earn; to win."

Acquiring talent is an ongoing process that has as much to do with how you run your business as with how you search for a candidate to fill an opening. It recognizes that your winery has a unique culture and specific core competency requirements that drive your success. It also recognizes that skilled talent has options, especially as the labor market shrinks and our expectations — for technical expertise, systems knowledge, interpersonal skills, and market savvy — expand.

The difference between "hiring employees" and "acquiring talent" reflects a paradigm shift that has taken place in many organizations. Rather than being content with workers who simply do what they are told, we now expect our employees to "act like owners" and be thoughtful about how they approach their tasks. Within this new paradigm, employees become partners in the success of the enterprise. Talent acquisition is the process of inviting new members into this partnership.

HOW DO YOU BECOME SUCCESSFUL AT TALENT ACQUISITION? Our recruiting and consulting experience shows that the most effective wineries focus their efforts on a wide range of initiatives. They understand that, to be successful at finding and attracting the best employees, they must give this effort their attention long before they have a job opening to fill and that it goes beyond developing excellent recruiting and selection skills.

They recognize that their efforts must include activities that will make them attractive as prospective employers. They must also have a plan for maximizing the value of new talent and integrating new employees into their organizations quickly.

Here are some successful initiatives that we have seen:

BUILD A "BEST PLACE TO WORK" WINERY. In today's marketplace, talented individuals are choosing more than a job. They are looking to join an organization that will provide a well-rounded, supportive environment where they will have the opportunity to hone their skills and make a strong contribution.

To attract these candidates, your employment brand is as important to talent acquisition as your product brand is to market success.

One element of your product branding campaign may be winning awards at professional tastings. In the same way, your employment branding campaign may include being designated as a "Best Place to Work." *Fortune* magazine publishes a list for large companies. Business Journals in many communities sponsor this designation for small local firms.

What does it take to become one of the best employers? The criteria in most of these contests mirror many of the best practices we see in well-managed wineries:

- Credibility, built through open, honest communication, respect for employees, demonstrated by valuing employee opinions, supporting career objectives, and understanding personal goals,
- Fairness in employment practices, such as pay, benefits, recognition, and handling of employee concerns and complaints,
- Teamwork and a friendly work atmosphere, where everyone works together to achieve a common goal,
- Recognition of the contribution that each individual makes to the success of the winery.

In an effort to build this type of work environment, some wineries conduct Employee Feedback surveys on a regular basis. These surveys serve as a gauge of employee satisfaction and provide information that is used to evaluate and improve management practices. These surveys also demonstrate to prospective employees that the winery's management team is open to hearing feedback about the organization and takes steps to ensure a productive, positive workplace.

MANAGE YOUR "HUMAN CAPITAL." Talented individuals want to know that when they join your winery, they will have the opportunity to grow and make a significant impact. Wineries that are successful in this area are skilled at staff planning and development. Some conduct a staff assessment, or "human capital review," as part of their strategic business planning sessions.

They ask questions such as: "Are we organized effectively for success?" "What talent do we have in each function?" "How are they performing?" "Are they in the right jobs?" "Do we have the technical, business, and interpersonal skills and experience in this group needed to achieve our goals — now and in two to five years?" "How can we develop these resources to be even more valuable to the organization — through cross-training, strengthening skills, or building the team?"

"If we don't have what we need, how shall we address this gap? Do we build internally, acquire the talent, or revise our goals?" These organizations use the resulting information to create development plans to strengthen their teams and to design recruiting plans for acquiring new talent.

The Human Capital Review process is a tool that these wineries use to actively shape their organizations and build the capacity to achieve their objectives. In addition, such a review process stimulates employee engagement by linking individual efforts to current and future goals.

From a talent-acquisition perspective, this process ensures that the skills and abilities needed in potential candidates are identified and linked to organizational goals. It also creates a work environment that actively encourages contribution and

development, both of which are important to attracting talented individuals.

BECOME SKILLED AT TALENT ASSESSMENT. Whether you use a search firm or conduct your own recruiting process, successful talent acquisition requires that you become skilled at identifying the skills your winery needs and being able to discern that a candidate possesses them.

In our experience as recruiters, we have identified several elements key to successful talent assessment:

- CREATE A CANDIDATE PROFILE TO DEFINE YOUR SEARCH CRITERIA — If you have completed your Human Capital Review, you'll have a good idea of your talent needs. You will have looked at your organizational structure and determined the job you need to fill. You will have defined the responsibilities and results that you expected from this position and the attributes a candidate must possess to be successful. Your candidate profile will include a thorough description of the position to be filled and a complete list of the skills (technical, business, and interpersonal) and experience you are seeking.
- CONDUCT INTERVIEWS THAT DEMONSTRATE THE CANDIDATE'S ABILITIES — Interview questions are useful to clarify facts on a resume and determine basic qualifications; however, skilled interviewers also ask questions that require thoughtful responses and reveal how candidates approach their work and use their experiences.

Skilled interviewers ask for examples and probe initial responses to deepen their understanding of a candidate's thought process. Useful questions ask for a description of past behavior ("Tell me about the most challenging assignment you ever worked on and how you completed it."); encourage value judgments ("What made you select winemaking as your life career?"); reveal attitudes ("Describe your most difficult boss and how you worked with him or her."); or require problem solving ("What would you say to an angry customer?").

Your questions should be based on the requirements in the candidate profile and should be the same for each candidate. This consistency allows for direct comparison between the candidates and the search criteria.

- OBTAIN BACKGROUND AND REFERENCE CHECKS — Part of the talent assessment process is verifying that a candidate is suitable for employment at your winery. It has become increasingly common for employers to conduct third-party background and reference checks on their final candidates.

These services, available through professional firms and online resources, might include verification of facts, such as employment history, educational degrees, professional licenses, or social security numbers, and screening for suitability, with credit history, criminal records, or driver's license records.

Each type of search has value, depending on the position being filled, and may also have legal limitations or requirements. It is therefore important to have any background checks completed by a knowledgeable company that can guide you through any compliance issues.

BE RIGOROUS ABOUT TALENT INTEGRATION. Once you have identified the talented individual that you would like to acquire for your team, consider treating that person from the start as a "partner" in your enterprise. Too often, wineries succeed at winning an exceptional performer, only to lose that key player or fail to see him or her achieve the anticipated success.

One of the consistent themes we hear from these organizations and the candidates themselves is that the new employee did not feel integrated into the organization. They "couldn't crack the code" or "couldn't get the traction necessary" to perform well.

We recommend taking several steps to ensure a successful start for your new "partner":

- Develop a detailed offer letter, describing the position, what you will provide (salary, benefits, etc.), and what you expect from the new employee (contingencies, such as I-9, physical exam, etc. , and any unusual requirements, such as an atypical work schedule or extensive travel.)
- Conduct a process to bring the employee "on board" that is thorough and provides guidance through at least the first 90 days of employment.

On-boarding is a critical phase of the talent acquisition process. It includes the initial orientation to the organization, department, position, and co-workers. It also includes a discussion of the specific expectations for 30, 60, and 90 days in the job, and of the general results expected at six months and one year.

For each expectation, it is useful to describe the specific outcome desired; how it will be measured; why it is important; what other departments or individuals are affected by this expectation and how they should be involved; what has been done in the past, including prior successes or challenges; and what resources are available and how to obtain them; etc.

- Assign a mentor or "buddy" who can help a new employee learn the language and norms of your winery's culture. Every organization has "landmines" that must be navigated, where political or social situations may have unusual significance and consequences for the uninitiated.

Sometimes the new employee's manager is the best mentor, however it is often most useful to assign a peer or higher-level employee who is savvy about the winery's culture and has a big-picture perspective on the workplace. This approach serves to provide support for the new employee, and provides a developmental experience for the mentor.

Summary

Talent acquisition is the process of building attractive opportunities for people who will add value to your organization. It is about entering into a partnership with the best and the brightest individuals to achieve a common goal: the success of your winery. This process will take time and effort — and will bring you rewards for years to come. ■

Anne Heron is a Senior Associate with The Personnel Perspective, a human resources consulting, training and recruiting firm in Santa Rosa, CA. Anne has over 25 years of management and HR experience. You can contact her at 707/576-7653.

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Smart Viticulture
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affected by climate change? Do you see relevant authorities developing long-term strategies for your wine sector? Is the appropriate research being done? Or do you (and they) not think about the issue at all?

Pancho Campo closed his address with a saying of the American Indians; *"We do not inherit the earth from our parents, but borrow it from our children."* Food for thought. ■

Dr. Richard Smart, "the flying vine-doctor," is an international viticultural consultant based in Launceston, Tasmania, in Australia. He can be contacted by e-mail: vinedoc@bigpond.net.au. Read about Dr. Smart's business, including his consulting schedule, educational wine tours, and seminars, at his home page http://www.smartvit.com.au. He visits America frequently and his consulting schedule is arranged by Vinquiry in Windsor, CA, tel: 707/ 838-6312 and http://www.vinquiry.com.

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